MODERN PRACTICAL ARITHMETIC

INTERMEDIATE

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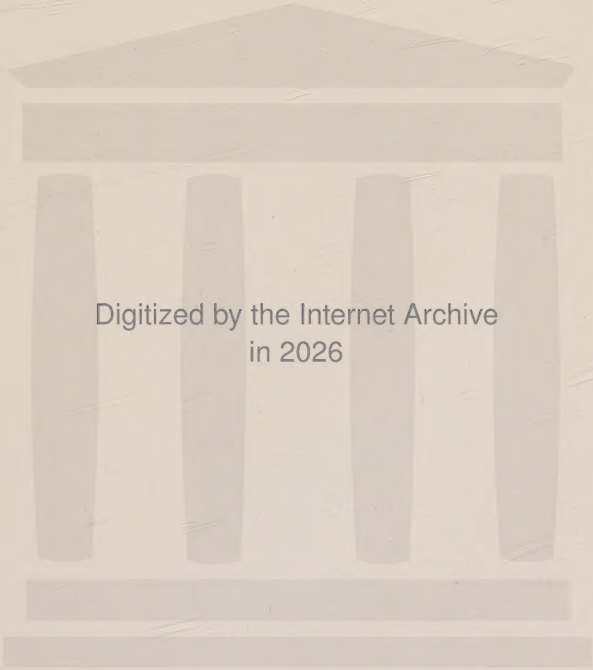

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MODERN PRACTICAL ARITHMETIC

BY

INA M. HAYES
CHARLES S. GIBSON
GEORGE R. BODLEY
BRUCE M. WATSON

INTERMEDIATE

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INTRODUCTION

THE *Modern Practical Arithmetics* have been prepared to meet the requirements of the newer syllabi, which, as they appear from time to time, place a new emphasis upon some particular phase of arithmetic study and teaching. Great care has been taken to provide proper presentation of all the fundamental processes and abundant exercises for thorough drill.

Frequent drills, mental tests, and lessons in review are presented according to a cumulative plan which is a distinctive feature of this series of arithmetics.

The relation of factor and product has been developed with extreme care and is so presented that it becomes a vital part of the child's mathematical sense.

Along with a realization of the preëminent usefulness of arithmetic in the everyday affairs of life, the authors have had constantly in mind also the fact that arithmetic is the path by which the student enters the greater field of general mathematics. It is essential to the student's further progress that facts and processes as presented in his arithmetic course shall conform to those he is to meet in his later study.

The problem study should not be confined to material contained in the book. It is essential that real problems be brought in from the immediate community upon which pupils may try their skill.

As a rule, projects are suggested rather than given in detail because, to be of greatest value, they must have

their origin in a local situation, — a store, a factory, a home, or a farm in the immediate community. The project should afford interesting practice in the processes already learned rather than serve as the main reliance in teaching new matter.

It is possible for all normal children to learn the fundamental facts of arithmetic. Some will learn them much more quickly than others. Some will be able to solve more difficult problems than others. The *Modern Practical Arithmetics* furnish material adapted to these various grades of ability. It is as grievous an error to permit the stronger pupils to pass along by meeting merely the minimum requirement, as to expect the weaker ones to perform tasks beyond their ability.

The child benefits most and takes greatest delight in solving problems from the world about him, which he or his teacher has brought to the class room to replace or supplement those of the text-book.

Over one hundred years ago, Thomas Dilworth in England and Nathan Daboll in America each called his arithmetic "The Schoolmaster's Assistant," — a significant title. It is the desire of the authors that these books shall be helpful assistants to the teachers of our time.

To the many teachers whose advice, suggestion, and contributions of material have aided in the preparation of this series the thanks of the authors are gratefully tendered.

STANDARDIZED TESTS

Certain standardized tests in arithmetic have been inserted in appropriate places. These tests can be used in two ways. In the first place, they set a number of definite goals to be attained by pupils. The examples of a given test define a definite ability, *i.e.*, the ability to do examples of this particular type. The standard for the test defines the degree of ability which pupils should attain by the time they complete the year's work in which the test is included. It is probably not wise to drill the pupils on such examples, except occasionally, after they have reached the standard.

The standardized tests also furnish a means of measuring the abilities of pupils. The tests have been inserted in the text at the places where their use is most important, but they may profitably be used at other times. In using the tests, the pupils should not be permitted to write the answers in the book. In doing all of the examples except the ones in division and common fractions, a sheet of plain paper should be placed with the edge just below the first row of examples. When doing the tests on common fractions, the sheet of paper is to be placed at the right hand side of the row. In division it will be necessary to copy the examples. In doing the other tests, the pupils should be instructed not to copy the examples, but all of the work and the answers should be done on the sheet of paper. When the first row has been completed, the pupils may turn the paper so that a fresh edge is placed under the next row of examples. If necessary, the paper may be folded so that a fresh edge may be formed.

In giving a test the pupils should be told exactly what to do but not coached on the examples or problems. They should be trained in responding promptly to the signals commonly used in giving standardized tests. When a test is given in the book, the teacher should make certain that each pupil has turned to the right page and is equipped with a blank sheet of paper. Direct the pupils to mark the place by putting the sheet of paper in the book and then to close it. Then say: "Attention! Ready, go!" At the end of the time to be allowed say: "Stop!"

All of the standardized tests are taken from the following well-known tests: Monroe's General Survey Scale in Arithmetic, Monroe's Diagnostic Tests in Arithmetic, and Monroe's Standardized Reasoning Tests. It is worth while, when possible, to obtain and use the regular printed form of these tests. Copies may be purchased from the Public School Publishing Company, Bloomington, Illinois.

DIRECTIONS FOR SCORING STANDARDIZED TEST — ARITHMETIC PROBLEMS

General Directions

1. In order that a solution may be counted as correct in principle the correct operation must be performed upon the correct numbers. For example, if a problem requires division, the right number must be used as a divisor.

2. A solution is counted as correct in principle when the operation performed is based upon the true relations of the numbers used.

3. The fact that a pupil does not use the shortest method is not to be counted against him. Our thinking is psychological. It is only necessary that each operation in the solution be based upon the true relations of the quantities.

4. Errors in denominate numbers (such as the number of months in a year, number of pounds in a ton, number of square feet in a square yard, etc.) do not affect the correctness of the principle.

5. No credit is given for a problem partially correct in principle. In a two-step problem, no credit is given unless the pupil at least has definitely indicated the last operation.

6. Answers are counted as correct only when the answer is numerically correct. If it contains a fraction, it must be reduced to its lowest terms. Answers need not be labeled; that is, if the answer is square feet, it is not necessary that it be labeled as such.

7. If a solution is incorrect in principle, the answer is also marked incorrect.

8. If a pupil solves a problem correctly and then continues with additional operations which are not called for, his solution becomes incorrect in both principle and answer.

Directions for Scoring Test Papers

1. Mark each problem for " correct principle " (P) and for " correct answer " (C).

2. These values for the test on 336 are as follows:

1.	P = 2	C = 1	**9.**	P = 1	C = 2
2.	P = 2	C = 2	**10.**	P = 2	C = 1
3.	P = 2	C = 2	**11.**	P = 3	C = 3
4.	P = 3	C = 2	**12.**	P = 3	C = 3
5.	P = 1	C = 1	**13.**	P = 2	C = 3
6.	P = 1	C = 2	**14.**	P = 1	C = 1
7.	P = 3	C = 2	**15.**	P = 2	C = 2
8.	P = 2	C = 2			

3. Find the sum of the "P" values of the problems correct in principle. This sum is the pupil's score for correct principle.

4. Similarly find the sum of the "C" values of those problems having correct answers. This sum is the pupil's score for correct answer.

5. Below are given detailed directions for scoring the test papers. Study them carefully before beginning to score papers.

Correct Solutions and Answers

The solutions below are not intended to cover all possible forms. Observe also that for the sake of brevity they are indicated by signs of operation. No importance is to be attached to this form of expression. The essential point is that the operation be performed. In multiplication, if the multiplier and multiplicand are reversed, accept as correct in principle. If the decimal point is wrongly placed, the principle may be correct although the answer must be wrong. The pupils are expected to do all of their work on the test papers.

1. $\frac{3}{4}$ yd. + $\frac{1}{8}$ yd. = $\frac{7}{8}$ yd.

2. 10 yd. − $4\frac{3}{8}$ yd. = $5\frac{5}{8}$ yd.

3. $63 \times 31.5 = 1984.5$ gal.

4. $6 \div \frac{3}{8} = 6 \times \frac{8}{3} = 16$, no. of days.

5. $\$1.90 \div .20 = \$.095$; $\$.095 \times 10 = \$.95$, or $\$1.90 \div 2 = \$.95$.

6. Addition of all items. *Ans.* 6.575.

7. $196 \div \frac{3}{5} = 196 \times \frac{5}{3} = 326\frac{2}{3}$, no. of loaves.

8. $12 \times \$12.85 = \$154.20$; $2\frac{3}{4} \times \$154.20 = \$424.05$, or $12 \times 2\frac{3}{4} = 33$; $33 \times \$12.85 = \$424.05$.

9. $\$6.50 + \$12.25 + \$5.20 + \$12.00 = \$35.95$. All items must be added in order to be counted correct in principle.

10. $12 \times 1\frac{3}{4}$ cents = 21 cents. Count as correct if these quantities are expressed in decimal form.

11. $\$12.50 + \$6.75 + \$.42 + \$17.30 + \$9.50 + \$42.75 + \$174.30 = \$263.52$; $\$263.52 - \$75.82 = \$187.70$.

12. $12 \times 2\frac{7}{8}$ yd. $= 34\frac{1}{2}$ yd.; $34\frac{1}{2} \times \$.12\frac{1}{2} = \$4.31\frac{1}{4}$, or $\$4.\frac{5}{16}$, or $2\frac{7}{8} \times \$.12\frac{1}{2} = \$.35\frac{15}{16}$; $12 \times \$.35\frac{15}{16} = \$4.31\frac{1}{4}$. It is not necessary that the $\frac{1}{4}$ be written in the answer.

13. $7850 \div 2000 = 3\frac{37}{40}$; $3\frac{37}{40} \times \$3.90 = \$15.31$.

14. $\$35.75 - \$28.50 = \$7.25$.

15. 500 bu. ÷ 40 = $12\frac{1}{2}$ bu.

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MODERN PRACTICAL ARITHMETIC

FIFTH GRADE — FIRST HALF

888,888,888

800,000,000	Eight hundred million.
80,000,000	Eighty million.
8,000,000	Eight million.
800,000	Eight hundred thousand.
80,000	Eighty thousand.
8,000	Eight thousand.
800	Eight hundred.
80	Eighty
8	Eight.

Notice how the *zeros* are used to give the 8 its different places and values.

Read:

1. 5; 50; 500; 5000; 50,000.
2. 60,000; 6000; 600; 60; 6.
3. 66,666; 44,444; 33,333; 22,222.
4. 1,000,000; 700,000; 10,000.
5. 1,010,000; 100,100; 10,010.
6. 205,600; 1,022,000; 200,202.
7. 375,000; 284,200; 28,020.
8. 92,000,000; 25,000; 346,284.

Write in figures:

1. Eight hundred eighty.
2. Eight hundred eighty-four thousand.
3. Eight hundred thousand.
4. Seven hundred twenty-two.
5. Seven thousand, two hundred twenty.
6. Seventy-two thousand, two hundred.
7. Seven hundred twenty thousand.
8. Nine hundred sixty-four.
9. Nine hundred sixty-four thousand.
10. Nine hundred sixty-four million.
11. Six hundred five.
12. Six hundred five thousand.
13. Six hundred five million.
14. Six thousand, fifty.
15. Six million, fifty thousand.
16. Sixty thousand, five hundred.
17. Sixty million, five hundred thousand.

Read the following numbers:

18. 36.
19. 369.
20. 3672.
21. 36,216.
22. 367,236.
23. 3,621,672.
24. 47.
25. 470.
26. 4704.
27. 47,282.
28. 471,880.
29. 4,794,188.
30. 398,156.
31. 9843.
32. 27,570.
33. 5349.
34. 216,438.
35. 48,650.
36. 7932.
37. 584,267.
38. 12,705.
39. 2,965,374.

1. *Add* 2, 3, 4, 5, 6, 7, 8, 9 *to each of the following numbers:*

a.	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*	*i.*
57	19	55	72	74	58	26	77	82
44	69	98	42	35	68	37	56	53
52	74	75	83	54	38	49	89	62
64	15	66	46	17	36	28	48	96
85	105	63	88	87	73	16	92	93
59	18	47	76	39	45	67	78	27

2. *Subtract* 2, 3, 4, 5, 6, 7, 8, 9, *from each of the above numbers.*

3. *Add columns rapidly:*

a.	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*	*i.*
9	8	4	5	6	7	8	9	7
4	6	7	9	3	5	5	8	5
3	5	6	7	4	6	4	7	8
7	4	9	6	5	9	7	4	6
5	7	8	4	6	8	8	5	4
6	9	5	7	7	5	9	6	9
7	6	9	8	9	4	6	7	6

j.	*k.*	*l.*	*m.*	*n.*	*o.*	*p.*	*q.*	*r.*
5	9	8	4	6	7	5	9	6
7	8	6	7	4	6	8	5	8
6	7	9	5	9	8	4	4	9
4	5	7	8	5	4	6	7	4
9	6	4	6	8	9	7	8	5
5	4	5	9	4	5	9	6	6
8	7	6	8	7	8	7	9	7

Add up; check by adding down:

1.	2.	3.	4.	5.	6.	7.	8.	9.
7	9	8	5	6	9	4	8	5
8	4	6	6	4	7	9	7	4
9	6	7	9	9	6	8	6	9
6	5	9	8	5	4	6	4	8
8	7	8	7	8	7	7	5	4
9	9	7	4	6	8	9	9	7
17	23	34	49	24	57	40	26	57

10.	11.	12.	13.	14.	15.	16.	17.	18.
8	8	6	7	9	4	9	8	7
7	9	8	5	6	9	7	3	6
6	7	8	9	4	6	5	8	9
9	6	9	4	7	4	6	6	4
4	8	4	6	8	7	7	9	8
8	4	3	8	9	8	4	7	7
60	39	55	42	20	67	48	33	28

19.	20.	21.	22.	23.	24.	25.	26.	27.
4	9	8	7	6	5	4	8	9
5	4	5	7	6	9	4	6	5
9	8	7	6	5	4	9	8	7
6	7	8	9	6	5	8	7	4
8	3	4	6	8	9	4	7	8
5	6	9	7	9	6	9	4	6
39	20	18	29	68	53	76	17	35

28.	29.	30.	31.	32.	33.	34.	35.	36.
9	6	8	4	5	7	5	6	9
8	7	5	6	4	6	9	8	4
7	5	9	8	9	5	6	4	6
90	68	86	97	78	89	77	96	78

1. Find the sum of 286, 324, 765, 801, 375, 28, and 642.

286	Add upward
324	Say "10, 15, 16, 21, 25, 31."
765	Write 1, add 3 to next column.
801	Say "7, 9, 16, 22, 24, 32."
375	Write 2, add 3 to next column.
28	Say "9, 12, 20, 27, 30, 32."
642	Write 32.
3221	Say "The sum is 3221."

Add:

2.	3.	4.	5.	6.	7.
79	303	336	286	489	719
111	286	727	590	978	455
388	355	479	998	323	996
194	258	296	275	284	530
183	410	147	182	842	855
390	675	386	252	643	297
346	824	315	80	381	763

8.	9.	10.	11.	12.	13.
223	357	469	606	242	260
876	569	303	479	37	161
292	202	636	846	271	398
774	468	464	567	832	569
136	942	213	516	513	281
672	183	163	792	552	145
213	488	330	554	936	769

Find the sum of \$2.43, \$1.27, \$6.45, \$5.00, and \$6.35.

1.	\$2.43	Write the addends so that the decimal points
	1.27	are in a column.
	6.45	Add, and place the decimal point, in the sum,
	5.00	directly below the points above.
	6.35	Place the dollar sign before the sum.
	\$21.50	*Sum*

Read, add, and read the sums:

2.	**3.**	**4.**	**5.**	**6.**
\$ 4.23	\$ .42	\$3.81	\$1.86	\$2.35
6.87	1.37	.59	2.35	4.16
4.19	.58	.47	4.81	.89
12.15	.69	.33	7.63	5.71
8.52	4.73	4.44	.48	.60

7.	**8.**	**9.**	**10.**
\$1.15	\$10.06	\$17.53	\$26.34
1.38	17.40	2.48	18.03
2.17	16.28	4.05	15.27
8.24	4.09	27.58	13.99
5.06	5.15	16.09	20.07

11.	**12.**	**13.**	**14.**
\$27.35	\$25.14	\$35.24	\$56.92
14.70	5.08	15.03	84.05
9.56	12.76	29.46	72.15
17.25	43.28	10.07	27.14
18.34	24.30	17.69	39.08
4.06	19.14	14.58	16.15
11.59	56.27	28.16	26.04

15. Find the sum of eighteen dollars and nine cents, sixteen dollars and twenty-four cents, seventy-five dollars and thirty-six cents, and twenty-two dollars.

1. From 6132 take 4275.

6132 4275 1857	Say "5 and 7 (write 7) = 12. 8 and 5 (write 5) = 13. 3 and 8 (write 8) = 11. 5 and 1 (write 1) = 6 The difference is 1857."

Subtract rapidly:

2.	8.	14.	20.
3275 1861	6024 5117	8119 6223	5123 2184
3.	**9.**	**15.**	**21.**
4161 3159	2197 1829	6077 4218	6792 3648
4.	**10.**	**16.**	**22.**
8249 7269	7294 2618	9721 7243	2498 1929
5.	**11.**	**17.**	**23.**
6222 4926	7891 6282	9824 7186	1296 1117
6.	**12.**	**18.**	**24.**
5624 2193	8927 6219	7916 4187	8164 5225
7.	**13.**	**19.**	**25.**
5824 3618	3127 2148	6923 1925	2916 1807

1.
$$\begin{cases} 65 + 27 = ? \\ 65 + 20 = 85. \\ 85 + \ \ 7 = 92 \ \textit{Sum.} \end{cases}$$
Say, "65, 85, 92."

In the same way give the sums of the following:

2. $24 + 25$.	**5.** $85 + 16$.	**8.** $58 + 45$.	**11.** $81 + 19$.
3. $38 + 43$.	**6.** $37 + 58$.	**9.** $43 + 59$.	**12.** $59 + 21$.
4. $72 + 19$.	**7.** $23 + 34$.	**10.** $64 + 27$.	**13.** $58 + 34$.

14.
$$\begin{cases} 65 - 27 = ? \\ 65 - 20 = 45. \\ 45 - \ \ 7 = 38 \ \textit{Difference.} \end{cases}$$
Say, "65, 45, 38."

15. $72 - 19$.	**18.** $76 - 29$.	**21.** $82 - 44$.	**24.** $45 - 18$.
16. $85 - 16$.	**19.** $93 - 37$.	**22.** $91 - 23$.	**25.** $37 - 19$.
17. $63 - 25$.	**20.** $64 - 35$.	**23.** $78 - 31$.	**26.** $92 - 78$.

27. John bought a plaid tie for 50 cents and a pair of brown stockings for 65 cents. He gave the clerk a two dollar bill. How much change did he receive?

28. Mary sold Frances her old geography for 68 cents, her arithmetic for 75 cents, and her speller for 23 cents. How much money did Frances pay Mary?

29. Kenneth had saved 87 cents. His mother gave him 63 cents after which he spent 34 cents. How many cents had he then?

30. Peggy's father gave her 70 cents. With the money she bought a tablet for 12 cents, a pencil box for 15 cents, and ice cream for 10 cents. How much money did she have left?

1. Subtract \$22.75 from \$47.62.

\$47.62 22.75 \$24.87	See that the decimal points are in a column. The decimal point in the remainder is directly beneath the other points. Write the dollar sign before the difference.

Subtract and test by addition:

2. \$12.12 10.00	5. \$15.96 14.88	8. \$72.72 35.86	11. \$61.61 59.73
3. \$13.65 11.11	6. \$17.27 16.36	9. \$71.88 30.30	12. \$163.63 159.70
4. \$14.78 12.98	7. \$36.72 35.80	10. \$68.44 33.66	13. \$194.24 19.40

14. \$505.25 47.25	16. \$619.25 147.50	18. \$4303.87 3296.96
15. \$559.50 69.25	17. \$2496.96 1727.27	19. \$5410.80 4901.47

20. Mrs. Jones bought a refrigerator for \$52.75. She gave the clerk \$55. What change did she receive?

21. A lady who had \$196 in the bank drew out \$76.75. How much money has she still in the bank?

22. In the Jefferson school there are 865 pupils. There are 386 boys. How many girls are in the school?

23. It cost \$8413.78 to fit up the manual training shop in our school, and \$9643.29 to fit up the kitchen. The kitchen cost how much more than the shop?

24. What sum added to \$15.08 will make \$25.00?

Find the sums:

1.	2.	3.	4.	5.
$36.24	$39.46	$26.19	$56.87	$16.40
19.81	27.83	17.15	19.52	94.87
15.04	91.14	47.36	13.09	29.58
35.29	6.09	25.98	47.34	70.07
18.74	7.16	16.08	29.55	27.51
12.06	14.38	27.59	72.80	98.46
19.70	29.43	3.14	46.33	88.29

6. An agent collected the following bills: $4.19 on Monday, $6.25 on Tuesday, $14.28 on Wednesday, $10.25 on Thursday, and $16.50 on Friday. What amount did he collect in five days?

7. Lucy spent $.15 for pencils, $.08 for a tablet, $.05 for an eraser, $.25 for a book, and $.04 for pens. What was the amount of her bill?

8. What is the entire cost of these groceries: flour, $1.95; butter, $1.10; sugar, $.49; meat, $1.48; potatoes, $.62; apples, $.50?

9. These pupils have deposits in the school bank as follows: Henry, $6.47; Ruth, $5.08; Robert, $7.95; Eliza, $9.32; John, $5.87. What is the total?

10. Harry's baseball outfit cost him as follows: uniform, $8.75; bat, $.75; ball, $1.25; catching-mit, $3.75; mask, $4.25. What was the cost of Harry's entire outfit?

11. Mr. Jerome bought a piano for $450, furniture for $440, a dining room rug for $47, a library lamp for $25, and a table spread for $12. How much did they cost?

12. Fred rode his wheel 25 miles on Monday, 28 miles on Tuesday, 34 miles on Wednesday, 38 miles on Thursday, and 19 miles on Friday. How many miles did he ride in five days?

13. A football team made the following scores against its opponents: 7, 21, 10, 14, 35, 16, and 28. Find the total number of points scored.

14. Add 9 dollars and 6 cents; 14 dollars and 8 cents; 68 dollars and 84 cents; 125 dollars and 28 cents; 4 dollars and 5 cents.

15. By selling papers, Harry made \$.35 on Monday, \$.46 on Tuesday, and \$.57 on Wednesday. How much did he make in the three days?

16. The sum of $467 + 298$ added to the sum of $856 + 294 + 586 = ?$

17. A father gave \$58 to each of his two sons, and \$65 to each of his two daughters. How much did his four children receive?

18. A lady bought a dozen lemons for 39 cents, one dozen bananas for 35 cents, three quarts of ice cream for \$1.95, and two watermelons for 80 cents each. How much did they all cost?

19. Find the cost of the following articles: coal, \$14.00; sugar, \$3.80; flour, \$13.72; pork, \$6.54; and clothing, \$47.98.

20. A man bought a lot for \$1957, built a house upon it for \$7888, paid a tax of \$156, and paid for insurance \$45. What was his entire expense?

21. $6¢ + \$1.03 + 13¢ + \$4 + 39¢ + 15¢ + \$9.45 = ?$

Subtract, and test by addition:

1. \$5911.91 512.93	4. 646,384 quarts 630,577 quarts	7. 655,850 yards 625,580 yards
2. \$3377.70 3296.89	5. 60,990 feet 49,441 feet	8. \$71,006.39 60,903.09
3. \$7163.90 7149.77	6. 43,387 gal. 459 gal.	9. \$469,753.25 206,861.16

10. A dairyman obtained 720 quarts of milk in a week. He kept 23 quarts and sold the rest. How many quarts did he sell?

11. A merchant bought 459 gallons of maple sirup. He sold 69 gallons. How many had he left?

12. It requires 711 gallons of paint to cover the roof of a building. How many gallons are left after 588 gallons have been used?

13. Mr. Gardner raised 1365 quarts of berries of which 619 quarts were blackberries. How many quarts of other berries were there?

14. In a military camp there are 15,969 soldiers. In this number there are 1280 officers. How many in the camp are not officers?

15. A boy earned \$42 during his vacation. He spent \$29 for clothes. How much money has he left?

16. Copy and add:

43678 + 45679 + 85463 + 46802 + 56347.
20895 + 37683 + 49060 + 53219 + 65128.
86498 + 93645 + 83962 + 69805 + 48039.

Find the products of the following:

1. 4×7268	6. 8×5312	11. 7×1357
2. 6×3613	7. 7×932	12. 6×2142
3. 7×2514	8. 5×5281	13. 4×3167
4. 9×1732	9. 6×2845	14. 5×1387
5. 5×273	10. 9×2389	15. 8×5671
16. 24×628	26. 34×762	36. 52×365
17. 73×119	27. 47×346	37. 38×269
18. 42×251	28. 63×527	38. 23×661
19. 36×598	29. 46×234	39. 77×579
20. 12×517	30. 29×737	40. 59×247
21. 26×826	31. 32×267	41. 87×563
22. 37×927	32. 13×643	42. 69×962
23. 44×512	33. 66×572	43. 45×742
24. 76×435	34. 71×163	44. 16×819
25. 65×659	35. 98×629	45. 93×152

46. A man buys 11 tons of coal at \$14 a ton. How much does his coal cost him?

47. Mr. Brown earns \$45 a week. How much does he earn in 52 weeks?

48. An automobile averages 18 miles on a gallon of gasoline. How many miles will it have traveled when 176 gallons of gasoline have been used?

49. A farmer raised 91 tons of hay and sold it for \$16 a ton. What did he receive for it?

1.	408	126	98
	89	20	760
	3672	2520	5880
	3264		686
	36312		74480

2.	78×207	9.	43×608	16.	62×307
3.	67×309	10.	91×402	17.	76×409
4.	52×504	11.	84×703	18.	87×704
5.	36×901	12.	19×805	19.	94×806
6.	25×109	13.	37×509	20.	53×905
7.	63×701	14.	55×807	21.	47×106
8.	49×603	15.	71×404	22.	82×506
23.	87×270	40.	76×350	57.	28×530
24.	70×278	41.	20×291	58.	91×670
25.	67×390	42.	19×620	59.	80×358
26.	60×937	43.	40×873	60.	43×830
27.	51×260	44.	63×930	61.	30×437
28.	40×621	45.	30×217	62.	61×560
29.	36×760	46.	57×310	63.	50×297
30.	42×450	47.	60×761	64.	76×340
31.	20×126	48.	38×980	65.	43×890
32.	30×739	49.	50×528	66.	90×587
33.	93×370	50.	45×260	67.	27×780
34.	50×354	51.	70×397	68.	40×627
35.	39×540	52.	34×230	69.	67×360
36.	24×610	53.	80×542	70.	16×440
37.	80×976	54.	72×790	71.	33×190
38.	18×760	55.	90×167	72.	46×490
39.	90×131	56.	12×470	73.	60×544

1. What is the cost of 7 sacks of flour at $1.95 each?

2. At $3.50 a day how much can a man earn in 8 days?

3. At $1.28 a yard what will 16 yards of cloth cost?

Find the cost of:

4. 24 chairs at $3.50.
5. 4 bbl. flour at $13.50.
6. 8 horses at $275.
7. 15 baseball bats at $1.25.
8. 7 tons of coal at $13.75.
9. 11 railroad tickets at $1.13.
10. 156 bars of soap at 7¢.
11. 60 panes of glass at 35¢.
12. 5 automobile tires at $34.20.
13. 16 bags of fertilizer at $4.64.
14. 42 bushels of potatoes at 90¢.
15. 1000 railroad ties at 85¢.
16. 63 gallons of sirup at $1.90.
17. 18 books at 86¢.
18. 4 pairs of shoes at $7.25.
19. 474 pounds of nails at 9¢.
20. 32 window screens at 85¢.
21. 63 yards of carpet at $3.42.
22. 35 histories at $1.12.
23. 85 readers at 60¢.

Divide:

1. $29 \div 7 =$	**2.** $7\overline{)29}$	**3.** $\frac{29}{7}$	**4.** $\frac{1}{7}$ of 29
5. $32 \div 5 =$	**6.** $5\overline{)38}$	**7.** $\frac{49}{5}$	**8.** $\frac{1}{5}$ of 45
9. $47 \div 6 =$	**10.** $6\overline{)43}$	**11.** $\frac{57}{6}$	**12.** $\frac{1}{6}$ of 76
13. $54 \div 5 =$	**14.** $5\overline{)36}$	**15.** $\frac{21}{5}$	**16.** $\frac{1}{5}$ of 42
17. $91 \div 8 =$	**18.** $8\overline{)87}$	**19.** $\frac{46}{8}$	**20.** $\frac{1}{8}$ of 62
21. $87 \div 9 =$	**22.** $9\overline{)58}$	**23.** $\frac{92}{9}$	**24.** $\frac{1}{9}$ of 24

25. *Divide each of the following by* 7:

15 22 36 61 74 43 68 39 27 82

26. *Divide each of the following by* 9:

98 76 53 86 65 47 92 28 51 37

27. *Divide each of the following by* 8:

21 83 19 79 94 47 68 45 34 93

28. *Divide each of the following by* 6:

34 55 49 71 58 29 62 35 67 56

29. *Divide each of the following by* 12:

45 16 47 43 86 93 74 29 37 85

Divide:

30. $6\overline{)34}$	**31.** $8\overline{)45}$	**32.** $9\overline{)68}$
33. $6\overline{)62}$	**34.** $8\overline{)22}$	**35.** $9\overline{)39}$
36. $6\overline{)49}$	**37.** $8\overline{)36}$	**38.** $9\overline{)91}$
39. $6\overline{)74}$	**40.** $8\overline{)47}$	**41.** $9\overline{)89}$
42. $6\overline{)58}$	**43.** $8\overline{)39}$	**44.** $9\overline{)67}$
45. $6\overline{)29}$	**46.** $8\overline{)35}$	**47.** $9\overline{)48}$
48. $6\overline{)71}$	**49.** $8\overline{)54}$	**50.** $9\overline{)71}$
51. $6\overline{)35}$	**52.** $8\overline{)93}$	**53.** $9\overline{)82}$

Divide:

1. $7\overline{)948}$	2. $846 \div 7 =$	3. $\frac{246}{7}$	4. $\frac{1}{7}$ of 742
5. $7\overline{)793}$	6. $924 \div 7 =$	7. $\frac{435}{7}$	8. $\frac{1}{7}$ of 399
9. $8\overline{)446}$	10. $732 \div 8 =$	11. $\frac{512}{8}$	12. $\frac{1}{8}$ of 381
13. $8\overline{)936}$	14. $614 \div 8 =$	15. $\frac{234}{8}$	16. $\frac{1}{8}$ of 423
17. $9\overline{)608}$	18. $972 \div 9 =$	19. $\frac{484}{9}$	20. $\frac{1}{9}$ of 833
21. $9\overline{)841}$	22. $588 \div 9 =$	23. $\frac{207}{9}$	24. $\frac{1}{9}$ of 378
25. $6\overline{)295}$	26. $364 \div 6 =$	27. $\frac{328}{6}$	28. $\frac{1}{6}$ of 294
29. $6\overline{)172}$	30. $139 \div 6 =$	31. $\frac{255}{6}$	32. $\frac{1}{6}$ of 196
33. $4\overline{)176}$	34. $149 \div 4 =$	35. $\frac{171}{4}$	36. $\frac{1}{4}$ of 259
37. $4\overline{)328}$	38. $316 \div 4 =$	39. $\frac{462}{4}$	40. $\frac{1}{4}$ of 901

Divide the following:

41. $9\overline{)209}$	48. $846 \div 7 =$	55. $\frac{321}{7}$	62. $\frac{1}{5}$ of 361
42. $7\overline{)336}$	49. $948 \div 6 =$	56. $\frac{482}{6}$	63. $\frac{1}{7}$ of 847
43. $6\overline{)923}$	50. $246 \div 8 =$	57. $\frac{218}{6}$	64. $\frac{1}{8}$ of 291
44. $8\overline{)872}$	51. $979 \div 9 =$	58. $\frac{127}{4}$	65. $\frac{1}{6}$ of 642
45. $6\overline{)127}$	52. $608 \div 8 =$	59. $\frac{585}{9}$	66. $\frac{1}{4}$ of 276
46. $6\overline{)132}$	53. $207 \div 6 =$	60. $\frac{908}{8}$	67. $\frac{1}{9}$ of 181
47. $4\overline{)168}$	54. $192 \div 4 =$	61. $\frac{373}{7}$	68. $\frac{1}{7}$ of 731

69. In how many weeks can a man pay a debt of \$945 if he pays \$9 each week?

70. An automobile goes at the rate of 30 miles an hour. In how many hours will it go 630 miles?

71. A man saves \$11 a month. In how many months will he save \$550?

```
   143
24)3452
   24
   ---
   105
    96
   ---
    92
    72
   ---
    20
```

Steps. 1. Divide
2. Multiply
3. Subtract
4. Bring down
5. Compare

TEST: 143 times 24 plus 20 = 3452
Quotient × Divisor + Remainder = Dividend

Find the quotients and remainders. Test:

1. 2280 ÷ 23	**6.** 3375 ÷ 25	**11.** 2440 ÷ 76
2. 5336 ÷ 44	**7.** 7221 ÷ 36	**12.** 8592 ÷ 24
3. 6495 ÷ 56	**8.** 1411 ÷ 65	**13.** 6430 ÷ 46
4. 1312 ÷ 52	**9.** 6554 ÷ 26	**14.** 7379 ÷ 54
5. 4256 ÷ 64	**10.** 5671 ÷ 34	**15.** 5686 ÷ 64

Divide and test:

16. 1081 ÷ 47	**21.** 4896 ÷ 68	**26.** 4212 ÷ 78
17. 2146 ÷ 58	**22.** 3696 ÷ 59	**27.** 6111 ÷ 97
18. 4898 ÷ 69	**23.** 6391 ÷ 77	**28.** 5954 ÷ 67
19. 3135 ÷ 57	**24.** 8096 ÷ 89	**29.** 6083 ÷ 79
20. 2493 ÷ 48	**25.** 2499 ÷ 49	**30.** 3567 ÷ 87

31. Thirty-two horses cost $4640. What was the average cost?

32. Crocker's Silk Shop bought 64 yards of silk and paid $71.68. How much did one yard of silk cost?

33. A bushel of potatoes weighs 60 lbs. How many bushels in a carload weighing 37,440 pounds?

Find quotients and test:

1. $19\overline{)209}$
2. $29\overline{)435}$
3. $23\overline{)356}$
4. $62\overline{)1364}$
5. $19\overline{)399}$
6. $39\overline{)936}$
7. $82\overline{)1148}$
8. $99\overline{)1089}$
9. $27\overline{)1701}$
10. $59\overline{)1298}$
11. $93\overline{)1934}$
12. $69\overline{)1658}$
13. $63\overline{)295}$
14. $59\overline{)2139}$
15. $33\overline{)1683}$
16. $47\overline{)4276}$
17. $54\overline{)3024}$
18. $28\overline{)1176}$

Divide and test:

19. 1818 by 18
20. 2614 by 27
21. 1835 by 36
22. 3014 by 45
23. 4482 by 54
24. 1513 by 63
25. 2987 by 29
26. 1596 by 38
27. 1692 by 47
28. 3192 by 56
29. 6371 by 65
30. 1702 by 74
31. 5251 by 89
32. 5226 by 78
33. 3751 by 67
34. 3472 by 56
35. 3027 by 34
36. 621 by 23

Find quotients and prove:

37. $44\overline{)2068}$
38. $54\overline{)3024}$
39. $63\overline{)4663}$
40. $95\overline{)8454}$
41. $87\overline{)6786}$
42. $76\overline{)4256}$
43. $68\overline{)5032}$
44. $29\overline{)1044}$
45. $36\overline{)972}$
46. $68\overline{)2992}$
47. $29\overline{)1972}$
48. $\frac{2346}{51}$
49. $\frac{8118}{82}$
50. $\frac{1593}{27}$
51. $\frac{1426}{23}$
52. $\frac{740}{19}$
53. $\frac{1511}{28}$
54. $\frac{1551}{33}$
55. $\frac{1764}{28}$
56. $\frac{5486}{59}$
57. $\frac{812}{27}$
58. $\frac{1187}{36}$
59. $\frac{1}{36}$ of 22356
60. $\frac{1}{35}$ of 1261
61. $\frac{1}{28}$ of 952
62. $\frac{1}{97}$ of 2532
63. $\frac{1}{67}$ of 5964
64. $\frac{1}{34}$ of 1710
65. $\frac{1}{64}$ of 5248
66. $\frac{1}{23}$ of 1706
67. $\frac{1}{48}$ of 5882
68. $\frac{1}{33}$ of 5276
69. $\frac{1}{47}$ of 1892

1. Divide 495,018 by 534.

$$
\begin{array}{r}
927 \\
534\overline{)495018} \\
4806 \\
\hline
1441 \\
1068 \\
\hline
3738 \\
3738 \\
\hline
\end{array}
$$

We find the quotient figures by saying, "5 in 49, in 14, in 37?"

2. Divide 84,148 by 193. What will be your trial divisor?

3. Divide 410,032 by 523.

4. Divide 18,432 by 512.

5. Divide 183,513 by 913.

Find the quotients:

6. $\frac{70794}{342}$	7. $\frac{252453}{817}$	8. $\frac{37995}{447}$	9. $\frac{8855}{385}$
10. $\frac{27268}{401}$	11. $\frac{476856}{716}$	12. $\frac{2048}{512}$	13. $\frac{63420}{604}$
14. $\frac{92008}{424}$	15. $\frac{619423}{827}$	16. $\frac{913632}{496}$	17. $\frac{98103}{617}$

Find quotients and remainders:

18. 12,324 ÷ 213	25. 4,312 ÷ 99
19. 32,634 ÷ 111	26. 8,432 ÷ 761
20. 22,724 ÷ 437	27. 31,845 ÷ 301
21. 23,919 ÷ 119	28. 29,631 ÷ 405
22. 18,647 ÷ 29	29. 293,476 ÷ 310
23. 11,502 ÷ 309	30. 82,437 ÷ 3100
24. 53,261 ÷ 205	31. 487,500 ÷ 500

A **factor** is one of the numbers multiplied together to produce a product.

1. *Give two factors of:* 35; 63; 81; 121; 56; 64; 40; 13; 72; 49; 32; 36; 84; 14.

Find two factors of each of the following:

2. 18.
3. 45.
4. 21.
5. 28.
6. 35.
7. 108.
8. 12.
9. 20.
10. 27.
11. 24.
12. 16.
13. 50.
14. 15.
15. 54.
16. 42.
17. 25.
18. 48.
19. 144.

Find the product or the missing factor:

20. $7 \times 8 = ?$
21. $9 \times ? = 63.$
22. $11 \times ? = 121.$
23. $7 \times 5 = ?$
24. $6 \times ? = 18.$
25. $? \times 7 = 42.$
26. $? \times 9 = 108.$
27. $5 \times ? = 60.$
28. $6 \times 9 = ?$
29. $8 \times 6 = ?$

Find the missing factor:

30. $27 \div ? = 3.$
31. $28 \div 7 = ?$
32. $? \div 11 = 7.$
33. $? \div 7 = 3.$
34. $121 \div ? = 11.$
35. $35 \div 5 = ?$
36. $? \div 11 = 12.$
37. $84 \div 7 = ?$
38. $72 \div ? = 8.$
39. $? \div 9 = 9.$

A number that will exactly contain another is a **multiple** of that number.

A number that will exactly contain each of two or more numbers is their **common multiple**.

Name a multiple of:

1. 7. **3.** 3. **5.** 12. **7.** 2. **9.** 8. **11.** 4.
2. 9. **4.** 5. **6.** 6. **8.** 10. **10.** 1. **12.** 11.

Give a common multiple of:

13. 7 and 8. **17.** 4 and 3. **21.** 8 and 12.
14. 4 and 10. **18.** 9 and 7. **22.** 11 and 3.
15. 9 and 3. **19.** 12 and 3. **23.** 5 and 9.
16. 5 and 6. **20.** 7 and 6. **24.** 8 and 4.

An integer that divides a number without a remainder is an **exact divisor** of that number.

An integer that has no factor except itself and 1 is a **prime number**.

A factor that is a prime number is a **prime factor**.

Give an exact divisor of:

25. 15. **27.** 21. **29.** 56. **31.** 28.
26. 32. **28.** 49. **30.** 12. **32.** 35.

Which of the following are prime numbers?

33. 3, 12, 9, 8, 7, 25, 36, 11, 13, 27, 50, 47.

Name all the prime factors of:

34. 28. **36.** 49. **38.** 80. **40.** 56.
35. 24. **37.** 81. **39.** 45. **41.** 121.

Analysis

Read the problem carefully to know

(1) What is given.

(2) What is to be found.

1. There are 680 pupils in one school, 233 in another, and 150 in another. How many pupils are there in the three schools?

The *number* of pupils is the sum of 680, 233, and 150, which is 1063. There are 1063 pupils.

2. Mr. Smith bought a house for $5000 and sold it for $6150. What did he gain?

The *number* of dollars gained is the difference between 5000 and 6150, which is 1150. He gained $1150.

3. A school of 150 pupils have only 110 books. How many pupils are without books?

The *number* of pupils without books is the difference between 150 and 110, which is 40. Forty pupils are without books.

4. What will 65 barrels of flour cost at $9 a barrel?

The *number* of dollars the flour will cost is the product of 65 and 9, which is 585. The flour will cost $585.

5. At 8 cents each how many oranges can I buy for 50¢?

The *number* of oranges I can buy is the quotient of 50 divided by 8, which is 6, with a remainder of 2. I can buy 6 oranges, and have 2¢ left.

6. Mr. Fox paid $24 for 12 chairs. How much did each chair cost?

The *number* of dollars he paid for one chair is the quotient of 24 divided by 12, which is 2. The chairs cost $2 each.

NOTE. — The above types of analysis are in harmony with the modern idea, that arithmetical operations are performed with numbers, — not with things.

Problems

1. Automobile tires cost $27.50 and gasoline 17 cents a gallon. How much must a man pay for 3 tires and 15 gallons of gasoline?

2. John bought 104 newspapers at 2 cents each and gave the dealer five dollars. What change should he receive?

3. Mary picked 97 quarts of berries. She received 4 cents a quart. She spent $2.17 of this money for school supplies. How much did she have left?

4. Mr. Thomas bought 10 tons of coal at $13.50 a ton and 6 cords of wood at $4.75 a cord. What did he pay for the coal and wood?

5. Mary had $1.73. She bought 2 dozen oranges at 5 cents each. How much change did she receive?

6. Jack's team earned $1.25 each day for 12 days. How many baseball suits could they buy at $5.00 each?

7. A boy sold 125 copies of *The Saturday Evening Post* at 5 cents each. He paid 3 cents a copy. How much money did he earn?

8. If 3 crates of berries cost $8.00, at the same rate what will 18 crates cost?

9. Mr. Broderick's 65 hens earned an average of $1.12 apiece last year. The expenses were $32.40. What was his profit?

10. A pupil saves 85 cents by using one paper towel instead of two. How much money will a fifth grade of 42 pupils save by following this pupil's example?

11. A trolley car averaging 45 passengers per trip makes 15 trips a day. If each passenger pays 7 cents, what is the total amount of fares collected?

12. The food for a cafeteria lunch costs $89.74. Three women work 4 hours at $.50 an hour each. What is the total cost of the lunch?

13. Mary buys 7 yards of goods at $1.45 a yard and 3 dozen buttons at 30 cents a dozen. Find the amount of Mary's purchase.

14. In our school cafeteria 350 pupils are served. 250 pupils are served in the first group. How many are left for the second group?

15. A milkman sells 1879 quarts of milk daily. He buys the milk at 9¢ a quart and sells it for 12¢ a quart. What is his daily profit?

16. Arithmetics cost $1.12 each, and geographies $1.31. What is the total cost of 22 arithmetics and 37 geographies?

17. What will it cost to keep 3 horses a year if each horse eats 150 bushels of oats at $1.20 a bushel and 2 tons of hay at $18 a ton?

18. A dressmaker makes a dress using 4 yards of material at $1.75 a yard and 3 yards of lace at $1.10 a yard. What is the cost of the material used in making the dress?

19. A merchant bought 200 pairs of overshoes at $2.55 a pair and 350 pairs of shoes at $3.85 a pair. How much did that stock cost him?

20. Coffee costs $.55 a pound and tea costs $.75. What will 7 pounds of coffee and 9 pounds of tea cost?

FRACTIONS

1. When any whole thing, as an orange, is divided into two equal parts, what is each part called?

2. If anything is divided into 3 equal parts, what is each part called? Into 4 equal parts? Into 8 equal parts? Into 12 equal parts?

A **fraction** is a part of a unit.

3. One half is written $\frac{1}{2}$. One third is written $\frac{1}{3}$.

4. Three fourths is written $\frac{3}{4}$. Write three eighths.

A **fraction** always indicates division.

$\frac{2}{3} = 2 \div 3 \qquad \frac{5}{8} = 5 \div 8 \qquad .5 = 5 \div 10$

A common fraction has two **terms**, a numerator and a denominator. The **numerator** is always a *dividend;* the **denominator** is always a *divisor.* The **value of the fraction** is the quotient of its numerator divided by its denominator.

A number which has no fractional part is **an integer.**

A number composed of an integer and a fraction is a **mixed number;** as, $3\frac{4}{5}$, $33\frac{1}{3}$.

$3\frac{1}{2}$ is read " three *and* one half."

4.25 is read " four *and* twenty-five hundredths."

In reading a mixed number read the integer, say " *and,*" then read the fraction.

A fraction whose value is less than 1 is a **proper fraction.** Its numerator is less than its denominator; as, $\frac{3}{4}$, $\frac{5}{12}$.

A fraction whose value is 1 or more than 1 is an **improper fraction.** Its numerator equals or exceeds its denominator; as, $\frac{4}{4}$, $\frac{12}{5}$.

Any integer may be written in the *form* of a *fraction* by writing it as a numerator with 1 as a denominator. $12 = \frac{12}{1}$, $5 = \frac{5}{1}$.

Give answers quickly. How many can you give in 2 minutes?

1. $\frac{1}{2}$ of 36	**6.** $\frac{1}{4}$ of 64	**11.** $\frac{1}{8}$ of 96
2. $\frac{1}{2}$ of 24	**7.** $\frac{1}{4}$ of 72	**12.** $\frac{1}{8}$ of 88
3. $\frac{1}{2}$ of 32	**8.** $\frac{1}{4}$ of 16	**13.** $\frac{1}{8}$ of 56
4. $\frac{1}{2}$ of 68	**9.** $\frac{1}{4}$ of 28	**14.** $\frac{1}{8}$ of 32
5. $\frac{1}{2}$ of 26	**10.** $\frac{1}{4}$ of 48	**15.** $\frac{1}{8}$ of 104
16. $\frac{1}{6}$ of 36	**21.** $\frac{1}{2}$ of 44	**26.** $\frac{1}{16}$ of 48
17. $\frac{1}{4}$ of 36	**22.** $\frac{1}{8}$ of 24	**27.** $\frac{1}{6}$ of 48
18. $\frac{1}{9}$ of 36	**23.** $\frac{1}{3}$ of 24	**28.** $\frac{1}{8}$ of 48
19. $\frac{1}{2}$ of 46	**24.** $\frac{1}{6}$ of 24	**29.** $\frac{1}{2}$ of 48
20. $\frac{1}{12}$ of 36	**25.** $\frac{1}{4}$ of 24	**30.** $\frac{1}{4}$ of 84
31. $\frac{1}{7}$ of 49	**36.** $\frac{1}{3}$ of 33	**41.** $\frac{1}{7}$ of 91
32. $\frac{1}{9}$ of 63	**37.** $\frac{1}{5}$ of 65	**42.** $\frac{1}{5}$ of 85
33. $\frac{1}{5}$ of 35	**38.** $\frac{1}{7}$ of 77	**43.** $\frac{1}{9}$ of 99
34. $\frac{1}{3}$ of 27	**39.** $\frac{1}{5}$ of 75	**44.** $\frac{1}{3}$ of 39
35. $\frac{1}{5}$ of 45	**40.** $\frac{1}{9}$ of 81	**45.** $\frac{1}{9}$ of 81

46. A man had 12 tons of coal and burned $\frac{1}{4}$ of it. How much did he burn?

47. John started on a journey of 27 miles. When he had gone $\frac{1}{3}$ of the distance, how far had he gone?

48. Mrs. Smith bought 100 lbs. of sugar and used $\frac{1}{2}$ of it. How much did she use?

49. James received 12 dollars for Christmas and spent $\frac{1}{3}$ of it for a pair of skates. How much did they cost?

50. What is $\frac{1}{4}$ of 68 quarts?

Addition of Fractions

$\frac{1}{7}$	The denominators are the same. Add	1 *seventh.*
$\frac{2}{7}$	the numerators, — as if the example were	2 *sevenths.*
$\frac{3}{7}$	set down thus:	3 *sevenths.*
	Note. — *The form at the right is for ex-*	6 *sevenths.*
$\frac{6}{7}$ *Sum*	*planation only.*	

Find the sums:

1.	2.	3.	4.	5.	6.	7.	8.
$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{7}$	$\frac{2}{9}$	$\frac{1}{10}$	$\frac{1}{11}$
$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{2}{7}$	$\frac{2}{9}$	$\frac{1}{10}$	$\frac{3}{11}$
$\frac{1}{3}$	$\frac{1}{4}$	$\frac{2}{5}$	$\frac{3}{6}$	$\frac{2}{7}$	$\frac{3}{9}$	$\frac{5}{10}$	$\frac{7}{11}$

9. $\frac{1}{12} + \frac{5}{12} + \frac{3}{12}$.
10. $\frac{1}{14} + \frac{3}{14} + \frac{5}{14}$.
11. $\frac{6}{15} + \frac{3}{15} + \frac{4}{15}$.
12. $\frac{3}{16} + \frac{3}{16} + \frac{3}{16}$.
13. $\frac{4}{18} + \frac{4}{18} + \frac{3}{18}$.
14. $\frac{3}{20} + \frac{5}{20} + \frac{3}{20}$.
15. $\frac{6}{22} + \frac{5}{22} + \frac{3}{22}$.
16. $\frac{9}{24} + \frac{3}{24} + \frac{5}{24}$.

$3\frac{1}{5}$	
$4\frac{2}{5}$	Add the fractions first.
$7\frac{1}{5}$	
$14\frac{4}{5}$ *Sum*	

Find the sums:

17.	19.	21.	23.
$3\frac{1}{2}$	$11\frac{2}{8}$	$6\frac{7}{20}$	$54\frac{7}{15}$
4	$5\frac{2}{8}$	$17\frac{5}{20}$	$21\frac{2}{15}$
5	$3\frac{2}{8}$	$23\frac{7}{20}$	$17\frac{4}{15}$

18.	20.	22.	24.
7	$16\frac{3}{8}$	$9\frac{9}{16}$	$45\frac{7}{12}$
$2\frac{1}{3}$	$11\frac{2}{8}$	$25\frac{3}{16}$	$29\frac{1}{12}$
9	$5\frac{1}{8}$	$17\frac{1}{16}$	$13\frac{3}{12}$

Find the sums:

25. $9\frac{1}{2}$, 5, 6

26. $21\frac{1}{5}$, $7\frac{2}{5}$, $12\frac{1}{5}$

27. $22\frac{2}{12}$, $16\frac{4}{12}$, $37\frac{1}{12}$

28. $60\frac{7}{25}$, $44\frac{11}{25}$, $18\frac{5}{25}$

29. $7\frac{4}{9}$, $8\frac{2}{9}$

30. $6\frac{2}{8}$, $11\frac{4}{8}$

31. $9\frac{3}{10}$, $12\frac{7}{10}$

32. $12\frac{2}{5}$, $5\frac{1}{5}$

33. $7\frac{5}{8}$, $12\frac{1}{8}$

34. $5\frac{7}{12}$, $12\frac{3}{12}$

35. $11\frac{3}{10}$, $7\frac{4}{10}$

36. $14\frac{6}{12}$, $6\frac{3}{12}$

37. $4\frac{7}{15}$, $14\frac{4}{15}$

38. $9\frac{9}{25}$, $6\frac{5}{25}$

39. $9\frac{3}{12}$, $7\frac{7}{12}$

40. $5\frac{5}{20}$, $14\frac{7}{20}$

41. $4\frac{1}{9}$, $3\frac{2}{9}$, $8\frac{5}{9}$

42. $6\frac{3}{8}$, $7\frac{2}{8}$, $2\frac{1}{8}$

43. $9\frac{5}{25}$, $4\frac{7}{25}$, $7\frac{11}{25}$

44. $7\frac{7}{25}$, $5\frac{6}{25}$, $6\frac{9}{25}$

45. $3\frac{3}{10}$, $7\frac{1}{10}$, $8\frac{4}{10}$

46. $8\frac{1}{8}$, $3\frac{3}{8}$, $7\frac{3}{8}$

47. $5\frac{5}{20}$, $4\frac{3}{20}$, $7\frac{7}{20}$

48. $4\frac{3}{5}$, $11\frac{1}{5}$, 3

49. $7\frac{4}{15}$, 3, $8\frac{7}{15}$

50. $4\frac{5}{12}$, $7\frac{6}{12}$, 5

51. $7\frac{1}{8}$, $3\frac{2}{8}$, $8\frac{4}{8}$

52. $9\frac{3}{10}$, 2, $9\frac{7}{10}$

53. $28\frac{4}{9}$, $57\frac{2}{9}$

54. $45\frac{4}{15}$, $97\frac{7}{15}$

55. $87\frac{7}{8}$, $99\frac{1}{8}$

56. $104\frac{11}{20}$, $92\frac{3}{20}$

57. $261\frac{5}{12}$, $87\frac{3}{12}$

58. $98\frac{3}{5}$, $104\frac{1}{5}$

59. $347\frac{7}{20}$, $88\frac{9}{20}$

60. $627\frac{7}{12}$, $196\frac{3}{12}$

61. $465\frac{2}{5}$, $187\frac{1}{5}$

62. $176\frac{5}{12}$, $89\frac{4}{12}$

63. $79\frac{2}{15}$, $97\frac{6}{15}$, 26

64. $147\frac{5}{9}$, $268\frac{4}{9}$, 121

65. $87\frac{3}{6}$, $65\frac{2}{6}$, $48\frac{1}{6}$

66. $67\frac{2}{8}$, $85\frac{1}{8}$, $79\frac{4}{8}$

67. $84\frac{3}{20}$, $97\frac{5}{20}$, $68\frac{9}{20}$

68. $77\frac{5}{12}$, $89\frac{1}{12}$, $63\frac{4}{12}$

69. $127\frac{2}{15}$, $89\frac{1}{15}$, $301\frac{7}{15}$

70. $88\frac{1}{7}$, $207\frac{2}{7}$, $49\frac{3}{7}$

71. $227\frac{7}{8}$, $456\frac{1}{8}$, $672\frac{3}{8}$

72. $401\frac{5}{16}$, $97\frac{4}{16}$, $528\frac{1}{16}$

Find the sums:

73. $7\frac{5}{8}$ + $3\frac{1}{8}$

74. $14\frac{5}{9}$ + $5\frac{2}{9}$

75. $16\frac{6}{25}$ + $7\frac{4}{25}$

76. $14\frac{7}{12}$ + $9\frac{5}{12}$

77. $15\frac{3}{8}$ + $6\frac{1}{8}$

78. $22\frac{7}{10}$ + $16\frac{4}{10}$

79. $40\frac{5}{6}$ + $30\frac{1}{6}$

80. $60\frac{17}{20}$ + $50\frac{5}{20}$

81. $21\frac{13}{15}$ + $7\frac{7}{15}$

82. $29\frac{7}{8}$ + $5\frac{3}{8}$

83. $20\frac{7}{12}$ + $14\frac{3}{12}$

84. $40\frac{7}{9}$ + $10\frac{2}{9}$

85. $19\frac{7}{8}$ + $8\frac{5}{8}$

86. $70\frac{9}{12}$ + $50\frac{5}{12}$

87. $17\frac{5}{6}$ + $8\frac{1}{6}$

88. $9\frac{8}{9}$ + $5\frac{5}{9}$

89. $20\frac{3}{4}$ + $16\frac{1}{4}$

90. $22\frac{15}{16}$ + $8\frac{7}{16}$

91. $30\frac{9}{12}$ + $10\frac{7}{12}$

92. $15\frac{7}{8}$ + $9\frac{2}{8}$

93. $26\frac{4}{5}$ + $16\frac{2}{5}$

94. $40\frac{5}{8}$ + $20\frac{3}{8}$

95. $27\frac{9}{12}$ + $18\frac{7}{12}$

96. $18\frac{21}{25}$ + $7\frac{6}{25}$

97. $61\frac{9}{15}$ + $17\frac{4}{15}$

98. $202\frac{6}{8}$ + $199\frac{3}{8}$

99. $181\frac{9}{25}$ + $67\frac{4}{25}$

100. $405\frac{14}{15}$ + $168\frac{8}{15}$

101. $200\frac{6}{20}$ + $199\frac{4}{20}$

102. $80\frac{5}{6}$ + $11\frac{1}{6}$

103. $167\frac{9}{10}$ + $98\frac{3}{10}$

104. $98\frac{12}{25}$ + $69\frac{7}{25}$

105. $222\frac{11}{20}$ + $188\frac{5}{20}$

106. $401\frac{7}{8}$ + $206\frac{5}{8}$

107. $365\frac{2}{3}$ + $172\frac{1}{3}$

108. $79\frac{4}{5}$ + $45\frac{3}{5}$

109. $276\frac{11}{12}$ + $91\frac{1}{12}$

110. $99\frac{4}{15}$ + $88\frac{1}{15}$

111. $478\frac{21}{25}$ + $289\frac{17}{25}$

112. $675\frac{15}{16}$ + $87\frac{5}{16}$

113. $407\frac{11}{12}$ + $9\frac{5}{12}$

114. $604\frac{9}{15}$ + $98\frac{4}{15}$

115. $196\frac{7}{8}$ + $186\frac{5}{8}$

116. $206\frac{8}{9}$ + $106\frac{7}{9}$

117. $99\frac{5}{6}$ + $11\frac{1}{6}$

118. $541\frac{18}{25}$ + $289\frac{10}{25}$

119. $200\frac{5}{9}$ + $100\frac{1}{9}$

120. $600\frac{7}{8}$ + $199\frac{1}{8}$

Subtraction of Fractions

$\frac{13}{15}$
$\frac{5}{15}$
$\frac{8}{15}$ *Difference*

The denominators are alike.
Subtract the numerators as if the example were written thus: . . . . .

13 fifteenths.
5 fifteenths.
8 fifteenths.

NOTE. — The form at the right is for *explanation only.*

1. $\frac{5}{8} - \frac{3}{8}$.
2. $\frac{3}{4} - \frac{1}{4}$.
3. $\frac{7}{9} - \frac{5}{9}$.
4. $\frac{9}{21} - \frac{3}{21}$.
5. $\frac{18}{24} - \frac{13}{24}$.
6. $\frac{21}{25} - \frac{5}{25}$.
7. $\frac{16}{18} - \frac{3}{18}$.
8. $\frac{11}{12} - \frac{6}{12}$.
9. $\frac{17}{20} - \frac{10}{20}$.
10. $\frac{21}{24} - \frac{9}{24}$.
11. $\frac{15}{16} - \frac{6}{16}$.
12. $\frac{17}{18} - \frac{5}{18}$.
13. $\frac{22}{23} - \frac{7}{23}$.
14. $\frac{15}{19} - \frac{8}{19}$.
15. $\frac{7}{8} - \frac{5}{8}$.

$7\frac{5}{8}$
$2\frac{2}{8}$
$5\frac{3}{8}$ *Difference*

Subtract the fractions first.

16. $6\frac{7}{9} - 4\frac{3}{9}$.
17. $15\frac{14}{15} - 5\frac{9}{15}$.
18. $18\frac{3}{8} - 3\frac{1}{8}$.
19. $21\frac{5}{7} - 8\frac{1}{7}$.
20. $40\frac{2}{3} - 11\frac{1}{3}$.
21. $75\frac{7}{10} - 6\frac{5}{10}$.
22. $81\frac{7}{8} - 9\frac{4}{8}$.
23. $55\frac{15}{16} - 37\frac{4}{16}$.
24. $22\frac{7}{12} - 8\frac{2}{12}$.
25. $90\frac{1}{8} - 61\frac{1}{8}$.
26. $17\frac{3}{5} - 9\frac{1}{5}$.
27. $25\frac{3}{8} - 16\frac{3}{8}$.
28. $30\frac{7}{10} - 12\frac{4}{10}$.
29. $64\frac{1}{5} - 50$.
30. $16\frac{3}{7} - 7\frac{3}{7}$.
31. $25\frac{7}{8} - 12$.

1. This circle is divided into halves. In the whole circle there are how many halves?

2. This circle is divided into thirds. In the whole circle there are how many thirds?

3. In the whole circle there are how many fourths?

A fraction like $\frac{4}{4}$, whose numerator and denominator are the same, *is equal to* 1. A fraction like $\frac{5}{4}$, whose numerator is greater than its denominator, is equal to *more than* 1. A fraction whose value is 1 or more than 1 is an **improper fraction.** Its numerator equals or exceeds its denominator.

4. How many sevenths are there in 1?
5. Change 1 to ninths.
6. Change 1 to twelfths.
7. How many tenths make 1?
8. How many fifths make 1?

Read and tell which are improper fractions:

9. $\frac{5}{6}$	**16.** $\frac{17}{16}$	**23.** $\frac{3}{9}$	**30.** $\frac{9}{10}$
10. $\frac{4}{5}$	**17.** $\frac{5}{9}$	**24.** $\frac{7}{9}$	**31.** $\frac{10}{10}$
11. $\frac{8}{8}$	**18.** $\frac{6}{6}$	**25.** $\frac{10}{11}$	**32.** $\frac{11}{10}$
12. $\frac{2}{3}$	**19.** $\frac{13}{24}$	**26.** $\frac{11}{10}$	**33.** $\frac{5}{16}$
13. $\frac{9}{7}$	**20.** $\frac{1}{1}$	**27.** $\frac{12}{3}$	**34.** $\frac{11}{16}$
14. $\frac{15}{16}$	**21.** $\frac{16}{10}$	**28.** $\frac{4}{2}$	**35.** $\frac{7}{24}$
15. $\frac{16}{16}$	**22.** $\frac{8}{9}$	**29.** $\frac{3}{10}$	**36.** $\frac{24}{10}$

Each of these circles is divided into fourths.

1. How many fourths of a circle are there in 2 circles? in 4 circles?

2. How many fourths of a circle are there in 3 circles? in 5 circles?

There are how many *thirds* of 1 in 5?

By addition $\frac{3}{3} + \frac{3}{3} + \frac{3}{3} + \frac{3}{3} + \frac{3}{3} = \frac{15}{3}$.
By multiplication 5×3 *thirds* = 15 *thirds*.

Changing the form of a number without changing its value is **reduction.**

Reduce:

3. 8 to halves. **6.** 3 to ninths. **9.** 8 to fifths.
4. 5 to fourths. **7.** 6 to sixths. **10.** 9 to halves.
5. 7 to thirds. **8.** 4 to sevenths. **11.** 12 to thirds.

Reduce $6\frac{2}{3}$ to an improper fraction.

First change 6 to thirds $\frac{18}{3}$
Then add $\frac{2}{3}$
$\frac{20}{3}$

Reduce to improper fractions:

12. $3\frac{1}{2}$ **16.** $3\frac{2}{3}$ **20.** $3\frac{1}{8}$ **24.** $7\frac{3}{8}$
13. $4\frac{1}{2}$ **17.** $2\frac{3}{4}$ **21.** $5\frac{3}{5}$ **25.** $8\frac{1}{5}$
14. $8\frac{1}{3}$ **18.** $4\frac{1}{5}$ **22.** $1\frac{1}{10}$ **26.** $6\frac{2}{5}$
15. $2\frac{1}{8}$ **19.** $3\frac{2}{5}$ **23.** $6\frac{3}{8}$ **27.** $4\frac{3}{10}$

A fraction always indicates division.

$\frac{20}{5}$ means the same as $20 \div 5$

$20 \div 5 = 4$ $\qquad$ $\frac{20}{5} = 4$

$\frac{17}{3}$ means the same as $17 \div 3$

$17 \div 3 = 5\frac{2}{3}$ $\qquad$ $\frac{17}{3} = 5\frac{2}{3}$

The *numerator* of a fraction is always a *dividend.*
The *denominator* of a fraction is always a *divisor.*
The *value* of a fraction is the *quotient* of its numerator divided by its denominator.

Find the value of:

1. $\frac{18}{3}$	6. $\frac{75}{5}$	11. $\frac{144}{8}$	16. $\frac{60}{12}$
2. $\frac{16}{2}$	7. $\frac{121}{11}$	12. $\frac{49}{7}$	17. $\frac{72}{6}$
3. $\frac{25}{5}$	8. $\frac{42}{21}$	13. $\frac{261}{9}$	18. $\frac{54}{9}$
4. $\frac{84}{4}$	9. $\frac{51}{3}$	14. $\frac{324}{18}$	19. $\frac{63}{21}$
5. $\frac{96}{12}$	10. $\frac{125}{25}$	15. $\frac{78}{13}$	20. $\frac{96}{16}$

Change to whole or mixed numbers:

21. $\frac{19}{2}$	31. $\frac{62}{5}$	41. $\frac{72}{9}$	51. $\frac{75}{8}$
22. $\frac{25}{4}$	32. $\frac{31}{2}$	42. $\frac{200}{7}$	52. $\frac{200}{3}$
23. $\frac{94}{9}$	33. $\frac{500}{6}$	43. $\frac{43}{2}$	53. $\frac{90}{11}$
24. $\frac{125}{10}$	34. $\frac{100}{8}$	44. $\frac{75}{15}$	54. $\frac{50}{16}$
25. $\frac{50}{4}$	35. $\frac{108}{9}$	45. $\frac{17}{4}$	55. $\frac{64}{2}$
26. $\frac{100}{12}$	36. $\frac{80}{12}$	46. $\frac{500}{8}$	56. $\frac{625}{10}$
27. $\frac{17}{3}$	37. $\frac{75}{2}$	47. $\frac{120}{9}$	57. $\frac{40}{3}$
28. $\frac{108}{8}$	38. $\frac{300}{8}$	48. $\frac{100}{6}$	58. $\frac{365}{7}$
29. $\frac{100}{3}$	39. $\frac{142}{10}$	49. $\frac{116}{3}$	59. $\frac{100}{5}$
30. $\frac{49}{5}$	40. $\frac{48}{15}$	50. $\frac{81}{8}$	60. $\frac{19}{4}$

What are the terms of a fraction?

The value of $\frac{24}{4}$ is 6. Let us notice how its value is changed as we multiply and divide its terms by 2.

$\frac{24}{4} \times 2 = \frac{48}{4}$
$\frac{48}{4} = 12$ or (2×6)

Multiplying the numerator (24) by 2 multiplies the value (6) by 2.

$\frac{24}{4} \div 2 = \frac{24}{2}$
$\frac{24}{2} = 12$ or (2×6)

Dividing the denominator (4) by 2 multiplies the value (6) by 2.

$\frac{24}{4} \div 2 = \frac{12}{4}$
$\frac{12}{4} = 3$ or $(6 \div 2)$

Dividing the numerator (24) by 2 divides the value (6) by 2.

$\frac{24}{4} \times 2 = \frac{24}{8}$
$\frac{24}{8} = 3$ or $(6 \div 2)$

Multiplying the denominator (4) by 2 divides the value (6) by 2.

$\frac{24}{4} \times 2 = \frac{48}{8} = 6$
$\frac{24}{4} \div 2 = \frac{12}{2} = 6$

Multiplying or dividing both numerator (24) and denominator (4) by 2 does not change the value.

These examples illustrate the following principles:

Prin. 1. *Multiplying the numerator, or dividing the denominator of a fraction by any number multiplies the fraction by that number.*

Prin. 2. *Dividing the numerator, or multiplying the denominator of a fraction by any number divides the fraction by that number.*

Prin. 3. *Multiplying or dividing both numerator and denominator by the same number does not change the value of the fraction.*

Into how many parts is this square divided?

Of the 12 parts in this square, how many 12ths are not shaded?

How many thirds of the square are not shaded?

Reduce $\frac{8}{12}$ to lower terms:

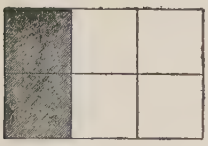
$$\frac{8}{12} \div \frac{2}{2} = \frac{4}{6}; \quad \frac{4}{6} \div \frac{2}{2} = \frac{2}{3}$$

By principle 3 we may divide both numerator and denominator of $\frac{8}{12}$ by 2. It then becomes $\frac{4}{6}$. We have now reduced $\frac{8}{12}$ to *lower terms*. Likewise we may divide both numerator and denominator of $\frac{4}{6}$ by 2 making it $\frac{2}{3}$. There is no whole number (except 1) which will divide both 2 and 3. They are said to be *prime to each other*. We have now reduced $\frac{8}{12}$ to its *lowest terms*.

We may reduce $\frac{8}{12}$ to its lowest terms at one operation by dividing both terms by 4.

Reduce to lowest terms:

1. $\frac{4}{8}$	11. $\frac{4}{6}$	21. $\frac{2}{6}$	31. $\frac{5}{10}$	41. $\frac{11}{33}$	51. $\frac{12}{24}$
2. $\frac{12}{36}$	12. $\frac{3}{6}$	22. $\frac{16}{24}$	32. $\frac{6}{9}$	42. $\frac{6}{12}$	52. $\frac{12}{18}$
3. $\frac{9}{12}$	13. $\frac{2}{8}$	23. $\frac{4}{16}$	33. $\frac{16}{20}$	43. $\frac{10}{15}$	53. $\frac{15}{20}$
4. $\frac{3}{12}$	14. $\frac{3}{9}$	24. $\frac{2}{18}$	34. $\frac{5}{15}$	44. $\frac{12}{16}$	54. $\frac{7}{14}$
5. $\frac{4}{12}$	15. $\frac{9}{18}$	25. $\frac{10}{30}$	35. $\frac{14}{21}$	45. $\frac{12}{36}$	55. $\frac{8}{32}$
6. $\frac{2}{10}$	16. $\frac{18}{27}$	26. $\frac{5}{20}$	36. $\frac{8}{16}$	46. $\frac{6}{18}$	56. $\frac{9}{24}$
7. $\frac{10}{20}$	17. $\frac{3}{15}$	27. $\frac{6}{8}$	37. $\frac{20}{30}$	47. $\frac{6}{24}$	57. $\frac{9}{27}$
8. $\frac{4}{10}$	18. $\frac{8}{20}$	28. $\frac{7}{21}$	38. $\frac{12}{32}$	48. $\frac{22}{33}$	58. $\frac{20}{32}$
9. $\frac{12}{15}$	19. $\frac{11}{22}$	29. $\frac{4}{20}$	39. $\frac{8}{24}$	49. $\frac{6}{15}$	59. $\frac{3}{33}$
10. $\frac{3}{27}$	20. $\frac{20}{40}$	30. $\frac{12}{20}$	40. $\frac{16}{20}$	50. $\frac{10}{16}$	60. $\frac{24}{36}$



One third of this rectangle is shaded. How many sixths of the rectangle are shaded?

Change $\frac{1}{3}$ to 6ths.

$$\frac{1 \times 2}{3 \times 2} = \frac{2}{6}$$

By principle 3 we may multiply both the numerator (1) and the denominator (3) by the same number. We select 2 because 2×3 (the denominator) is 6. The result is $\frac{2}{6}$. We have reduced $\frac{1}{3}$ to *higher terms*.

1. Change $\frac{1}{2}$ to 4ths.
2. Change $\frac{1}{2}$ to 8ths.
3. Change $\frac{1}{3}$ to 9ths.
4. Change to 12ths: $\frac{1}{3}$; $\frac{1}{2}$; $\frac{1}{4}$.
5. Change to 15ths: $\frac{1}{3}$; $\frac{1}{5}$.
6. Change to 16ths: $\frac{1}{2}$; $\frac{1}{8}$; $\frac{1}{4}$; $\frac{3}{4}$; $\frac{3}{8}$.

Change:

7. $\frac{2}{5}$ to 10ths.
8. $\frac{3}{8}$ to 24ths.
9. $\frac{4}{5}$ to 20ths.
10. $\frac{3}{7}$ to 21sts.
11. $\frac{5}{12}$ to 24ths.
12. $\frac{3}{5}$ to 15ths.
13. $\frac{5}{8}$ to 16ths.
14. $\frac{2}{3}$ to 9ths.
15. $\frac{2}{3}$ to 12ths.
16. $\frac{4}{5}$ to 10ths.
17. $\frac{3}{4}$ to 12ths.
18. $\frac{3}{12}$ to 24ths.
19. $\frac{2}{3}$ to 18ths.
20. $\frac{3}{5}$ to 25ths.
21. $\frac{1}{4}$ to 12ths.
22. $\frac{4}{11}$ to 22nds.
23. $\frac{8}{9}$ to 27ths.
24. $\frac{1}{8}$ to 32nds.
25. $\frac{5}{7}$ to 28ths.
26. $\frac{7}{8}$ to 24ths.
27. $\frac{3}{10}$ to 30ths.
28. $\frac{9}{12}$ to 36ths.

1. What number will contain both 2 and 3? 2 and 5? 3 and 5?

2. What is the smallest number that will contain both 2 and 4? 3 and 6? 2 and 6? 4 and 6?

3. What are the denominators of $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$?

4. What number will contain each of the denominators of $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{6}$?

If we wish to add or to subtract two fractions, like $\frac{1}{2}$ and $\frac{1}{3}$, we must first change them to fractions having the same denominator. We choose a denominator that will contain both 2 and 3, as 6, and reduce both $\frac{1}{2}$ and $\frac{1}{3}$ to fractions having the denominator chosen.

$\frac{1}{2} = \frac{3}{6}$. $\frac{1}{3} = \frac{2}{6}$.

Fractions having the same denominator are said to have a **common denominator.**

Always choose as small a denominator as you can.

Change to fractions having the same denominator:

1. $\frac{1}{2}, \frac{1}{4}$	6. $\frac{1}{2}, \frac{1}{3}$	11. $\frac{1}{4}, \frac{1}{6}$	16. $\frac{1}{3}, \frac{1}{5}$
2. $\frac{1}{3}, \frac{1}{6}$	7. $\frac{1}{4}, \frac{1}{8}$	12. $\frac{3}{4}, \frac{2}{5}$	17. $\frac{2}{3}, \frac{3}{4}$
3. $\frac{1}{2}, \frac{3}{8}$	8. $\frac{1}{2}, \frac{2}{3}$	13. $\frac{1}{5}, \frac{1}{10}$	18. $\frac{3}{4}, \frac{1}{8}$
4. $\frac{1}{3}, \frac{1}{9}$	9. $\frac{1}{4}, \frac{1}{5}$	14. $\frac{1}{2}, \frac{3}{4}$	19. $\frac{3}{4}, \frac{1}{16}$
5. $\frac{2}{5}, \frac{3}{15}$	10. $\frac{1}{3}, \frac{3}{4}$	15. $\frac{1}{3}, \frac{5}{6}$	20. $\frac{2}{5}, \frac{3}{4}$

Change to fractions having a common denominator:

21. $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}$	26. $\frac{3}{4}, \frac{1}{6}, \frac{5}{12}$	31. $\frac{2}{3}, \frac{1}{2}, \frac{3}{8}$
22. $\frac{1}{3}, \frac{5}{6}, \frac{7}{12}$	27. $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}$	32. $\frac{1}{2}, \frac{3}{4}, \frac{6}{20}$
23. $\frac{1}{5}, \frac{3}{4}, \frac{5}{10}$	28. $\frac{2}{3}, \frac{1}{9}, \frac{5}{6}$	33. $\frac{1}{5}, \frac{1}{4}, \frac{1}{20}$
24. $\frac{1}{3}, \frac{1}{4}, \frac{5}{12}$	29. $\frac{2}{5}, \frac{1}{2}, \frac{3}{10}$	34. $\frac{5}{6}, \frac{1}{4}, \frac{7}{12}$
25. $\frac{2}{3}, \frac{3}{4}, \frac{5}{6}$	30. $\frac{5}{9}, \frac{1}{3}, \frac{5}{18}$	35. $\frac{2}{3}, \frac{1}{2}, \frac{7}{9}$

$\frac{1}{3} + \frac{2}{5} = ?$

$\frac{1}{3} = \frac{5}{15}$

$\frac{2}{5} = \frac{6}{15}$

$\frac{11}{15}$

See that the fractions have a common denominator, then add the numerators.

Add:

1. $\frac{1}{2}$ and $\frac{1}{6}$
2. $\frac{1}{3}$ and $\frac{1}{4}$
3. $\frac{1}{2}$ and $\frac{3}{8}$
4. $\frac{2}{3}$ and $\frac{1}{9}$
5. $\frac{4}{5}$ and $\frac{2}{15}$
6. $\frac{1}{2}$ and $\frac{2}{3}$
7. $\frac{1}{4}$ and $\frac{3}{8}$
8. $\frac{1}{2}$ and $\frac{3}{5}$
9. $\frac{1}{3}$ and $\frac{3}{4}$
10. $\frac{2}{3}$ and $\frac{3}{5}$
11. $\frac{1}{2}$ and $\frac{3}{5}$
12. $\frac{3}{4}$ and $\frac{2}{5}$
13. $\frac{1}{2}$ and $\frac{3}{4}$
14. $\frac{2}{3}$ and $\frac{5}{6}$
15. $\frac{2}{3}$ and $\frac{3}{4}$
16. $\frac{3}{4}$ and $\frac{5}{8}$
17. $\frac{3}{8}$ and $\frac{5}{16}$
18. $\frac{3}{4}$ and $\frac{3}{16}$
19. $\frac{1}{2}$ and $\frac{1}{2}$
20. $\frac{4}{9}$ and $\frac{1}{2}$
21. $\frac{1}{2}$ and $\frac{1}{4}$ and $\frac{1}{8}$
22. $\frac{3}{4}$ and $\frac{5}{6}$ and $\frac{1}{12}$
23. $\frac{2}{3}$ and $\frac{5}{6}$ and $\frac{5}{12}$
24. $\frac{3}{5}$ and $\frac{3}{4}$ and $\frac{3}{10}$
25. $\frac{2}{3}$ and $\frac{3}{4}$ and $\frac{1}{12}$
26. $\frac{1}{3}$ and $\frac{3}{4}$ and $\frac{5}{6}$
27. $\frac{1}{9}$ and $\frac{2}{3}$ and $\frac{1}{18}$
28. $\frac{2}{5}$ and $\frac{1}{2}$ and $\frac{7}{10}$
29. $\frac{2}{3}$ and $\frac{2}{9}$ and $\frac{1}{6}$
30. $\frac{3}{4}$ and $\frac{5}{6}$ and $\frac{7}{12}$

$\frac{2}{3} - \frac{1}{4} = ?$

$\frac{2}{3} = \frac{8}{12}$

$\frac{1}{4} = \frac{3}{12}$

$\frac{5}{12}$

See that the fractions have a common denominator, then subtract the numerators.

Find the difference between:

31. $\frac{3}{4}$ and $\frac{1}{2}$
32. $\frac{1}{2}$ and $\frac{1}{3}$
33. $\frac{5}{6}$ and $\frac{2}{3}$
34. $\frac{3}{4}$ and $\frac{3}{8}$
35. $\frac{3}{5}$ and $\frac{1}{2}$
36. $\frac{5}{6}$ and $\frac{3}{4}$
37. $\frac{1}{2}$ and $\frac{1}{8}$
38. $\frac{1}{3}$ and $\frac{1}{4}$
39. $\frac{3}{4}$ and $\frac{2}{3}$
40. $\frac{7}{8}$ and $\frac{3}{4}$
41. $\frac{4}{5}$ and $\frac{2}{3}$
42. $\frac{5}{8}$ and $\frac{1}{3}$
43. $\frac{4}{5}$ and $\frac{2}{3}$
44. $\frac{2}{3}$ and $\frac{1}{4}$
45. $\frac{5}{6}$ and $\frac{3}{8}$

Optional

An integer that divides a number without a remainder is an **exact divisor** of that number.

A *divisor* of a number is also called a factor of that number.

A **prime number** is an integer that has no factor except itself and 1.

A factor that is a prime number is a **prime factor.**

Give two factors of:

1. 12. **3.** 15. **5.** 20. **7.** 21. **9.** 24. **11.** 28.

2. 16. **4.** 8. **6.** 6. **8.** 18. **10.** 32. **12.** 27.

13. Which of the following are prime numbers, and why: 2, 1, 7, 15, 11, 4, 3, 10, 9, 8, 13 ?

14. Name all the prime numbers from 1 to 20.

Give two prime factors of:

15. 14. **17.** 15. **19.** 42. **21.** 36. **23.** 28. **25.** 44.

16. 22. **18.** 36. **20.** 40. **22.** 35. **24.** 50. **26.** 20.

Give all the prime factors of:

27. 16. **28.** 15. **29.** 18. **30.** 24. **31.** 28. **32.** 32.

An integer that will exactly divide each of two or more numbers is called their **common divisor.**

Name a common divisor of:

33. 6 and 9. **36.** 24 and 30. **39.** 18 and 32.

34. 4 and 10. **37.** 20 and 36. **40.** 16 and 40.

35. 12 and 18. **38.** 15 and 40. **41.** 27 and 36.

Optional

The *largest* integer that will exactly divide each of two or more numbers is called their **greatest common divisor.**

G.C.D. stands for *Greatest Common Divisor.*

The greatest common divisor may often be found by inspection. See if the smallest of the given numbers will exactly divide each of the others. If it will, it is the greatest common divisor. If it will not, try $\frac{1}{2}$ of it, then $\frac{1}{3}$ of it, then $\frac{1}{4}$ of it, and so on until a number is found that will divide each of the others.

1. What is the G.C.D. of 16, 24, and 36?

We first try 16. It is not contained in 24 or 36.
Try $\frac{1}{2}$ of 16 or 8. It will not divide 36.
Try $\frac{1}{4}$ of 16 or 4. It divides each of them. 4 is the G.C.D.

2. 4, 8, 16. **4.** 3, 9, 15. **6.** 10, 25, 40. **8.** 12, 18, 30.
3. 4, 8, 10. **5.** 9, 15, 24. **7.** 8, 12, 22. **9.** 15, 27, 45.

The G.C.D. may be found from the prime factors of the given numbers. Separate each number into its prime factors. Take each prime factor the number of times it occurs in *every* given number, and the product is the G.C.D. If no such factor is found, the G.C.D. is 1.

10. What is the G.C.D. of 30, 45, and 75?

$30 = 2 \times 3 \times 5$ 2 does not occur in 45 or 75.
$45 = 3 \times 3 \times 5$ 3 occurs *once* in *every* number.
$75 = 3 \times 5 \times 5$ 5 occurs *once* in *every* number.
$3 \times 5 = 15$. *G.C.D.* 3×5, or 15 is the G.C.D.

11. 8, 16, 24. **13.** 16, 40, 64. **15.** 36, 48, 66.
12. 9, 24, 45. **14.** 24, 60, 96. **16.** 30, 70, 90.

A number that will exactly contain another is called a **multiple** of that number.

Name a multiple of :

1. 4. **3.** 7. **5.** 8. **7.** 2. **9.** 15.

2. 3. **4.** 12. **6.** 10. **8.** 9. **10.** 11.

11. Name two multiples of 5.

12. Give two numbers that are multiples of 6.

13. Give two multiples of 8.

14. Give three multiples of each of the following:
2, 3, 4, 5, 6

15. Give two multiples of each of the following:
20, 30, 10, 40, 50

A number that will exactly contain each of *two or more* numbers is called their **common multiple.**

18 is a common multiple of 3 and 9.

Give a common multiple of :

16. 2 and 3. **19.** 3 and 4. **22.** 5 and 6. **25.** 6 and 8.

17. 3 and 5. **20.** 4 and 5. **23.** 4 and 9. **26.** 4 and 10.

18. 2 and 5. **21.** 6 and 4. **24.** 6 and 7. **27.** 7 and 8.

The *smallest number* that will exactly contain each of two or more numbers is called their **least common multiple.**

L.C.M. stands for *least common multiple.*

The least common multiple of two or more numbers may often be found by inspection. See if the largest of the given numbers will contain each of the others. If it will, it is the least common multiple. If it will not, multiply it by 2, then by 3, then by 4, and so on, until a number is found that will contain each of the others.

1. What is the L.C.M. of 2, 6, 10?

We first try 10. It will not contain 6.
Then try 20. It also will not contain 6.
Then try 30. It will contain 2, 6 and 10. **30** is the L.C.M.

Find by inspection the L.C.M. of:

2. 2, 3, 4.	**5.** 2, 3, 9.	**8.** 2, 3, 6, 8.
3. 3, 6, 9.	**6.** 2, 3, 6.	**9.** 3, 4, 8, 16.
4. 2, 6, 8.	**7.** 4, 6, 8.	**10.** 3, 4, 6, 8.

The L.C.M. of two or more numbers may be found from their prime factors.

Separate each number into its prime factors.

Take each prime factor the *greatest* number of times it occurs in *any one* of the given numbers, and their product is the L.C.M.

11. What is the L.C.M. of 30, 45 and 75?

$30 = 2 \times 3 \times 5$ 2 occurs *once*, in 30.
$45 = 3 \times 3 \times 5$ 3 occurs *twice*, in 45.
$75 = 3 \times 5 \times 5$ 5 occurs *twice*, in 75.
$2 \times 3 \times 3 \times 5 \times 5 = 450$ L.C.M.

Find the L.C.M. of:

12. 6 and 10.	**15.** 4 and 18.	**18.** 16 and 24.
13. 8 and 12.	**16.** 12 and 16.	**19.** 28 and 42.
14. 9 and 12.	**17.** 15 and 20.	**20.** 4, 6 and 18.

Fractions with *the same denominator* are said to have a **common denominator.**

The smallest common denominator that two or more fractions can have is their **least common denominator.**

To find the least common denominator find the L.C.M. of the given denominators.

Reduce $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{2}{3}$ to fractions having a least common denominator.

$\frac{3}{4} = \frac{9}{12}$
$\frac{5}{6} = \frac{10}{12}$
$\frac{2}{3} = \frac{8}{12}$ *Ans.*

Change the following to fractions having the least common denominator:

1. $\frac{1}{2}, \frac{3}{4}$
2. $\frac{2}{3}, \frac{5}{6}$
3. $\frac{1}{2}, \frac{7}{9}$
4. $\frac{5}{7}, \frac{1}{14}, \frac{1}{2}$
5. $\frac{1}{5}, \frac{1}{3}, \frac{7}{15}$
6. $\frac{1}{2}, \frac{2}{7}, \frac{1}{21}$
7. $\frac{2}{2}, \frac{5}{9}, \frac{7}{18}$
8. $\frac{5}{6}, \frac{3}{4}, \frac{2}{3}$
9. $\frac{6}{5}, \frac{5}{6}, \frac{1}{2}$
10. $\frac{7}{9}, \frac{2}{3}, \frac{3}{2}$
11. $\frac{1}{2}, \frac{3}{4}, \frac{5}{6}, \frac{7}{12}$
12. $\frac{1}{3}, \frac{2}{5}, \frac{2}{3}, \frac{7}{15}$
13. $\frac{5}{24}, \frac{1}{8}, \frac{1}{3}$
14. $\frac{3}{8}, \frac{7}{12}, \frac{5}{6}$
15. $\frac{5}{9}, \frac{1}{2}, \frac{1}{6}$
16. $\frac{7}{8}, \frac{2}{3}, \frac{5}{12}$
17. $\frac{5}{7}, \frac{2}{5}, \frac{11}{21}$
18. $\frac{1}{2}, \frac{7}{15}, \frac{3}{10}$
19. $\frac{7}{9}, \frac{5}{6}, \frac{1}{2}, \frac{1}{3}$
20. $\frac{1}{4}, \frac{2}{3}, \frac{11}{12}, \frac{7}{8}$
21. $\frac{1}{7}, \frac{1}{14}, \frac{1}{4}, \frac{1}{2}$
22. $\frac{5}{7}, \frac{3}{14}, \frac{3}{4}, \frac{19}{28}$
23. $\frac{1}{7}, \frac{1}{8}, \frac{1}{4}, \frac{1}{2}$
24. $\frac{3}{7}, \frac{5}{8}, \frac{3}{4}, \frac{1}{28}$
25. $\frac{1}{9}, \frac{1}{6}, \frac{1}{4}, \frac{1}{3}, \frac{1}{12}$
26. $\frac{7}{9}, \frac{2}{3}, \frac{5}{6}, \frac{7}{12}, \frac{1}{18}$
27. $\frac{3}{4}, \frac{7}{8}, \frac{11}{16}, \frac{19}{32}, \frac{1}{2}$
28. $\frac{3}{8}, \frac{1}{4}, \frac{5}{6}, \frac{2}{3}$
29. $\frac{8}{27}, \frac{4}{9}, \frac{1}{2}, \frac{2}{3}$
30. $\frac{16}{24}, \frac{5}{8}, \frac{5}{6}, \frac{3}{4}$
31. $\frac{4}{5}, \frac{7}{15}, \frac{3}{10}, \frac{2}{3}$
32. $\frac{5}{9}, \frac{5}{6}, \frac{2}{3}, \frac{1}{2}$
33. $\frac{2}{3}, \frac{3}{4}, \frac{5}{6}, \frac{7}{8}$
34. $\frac{9}{12}, \frac{7}{18}, \frac{5}{6}, \frac{4}{9}$
35. $\frac{7}{5}, \frac{5}{6}, \frac{9}{15}, \frac{3}{10}$
36. $\frac{17}{25}, \frac{6}{5}, \frac{1}{2}, \frac{7}{10}$
37. $\frac{7}{8}, \frac{5}{4}, \frac{1}{2}, \frac{11}{16}$
38. $\frac{5}{27}, \frac{8}{3}, \frac{8}{9}, \frac{5}{6}$
39. $\frac{35}{42}, \frac{3}{7}, \frac{5}{6}, \frac{7}{12}$
40. $\frac{19}{28}, \frac{1}{2}, \frac{3}{4}, \frac{7}{8}$
41. $\frac{25}{32}, \frac{15}{16}, \frac{5}{8}, \frac{2}{3}$
42. $\frac{22}{45}, \frac{8}{9}, \frac{9}{10}, \frac{7}{15}$

Fractions, to be added, must be given a common denominator.

Find the sum of $\frac{7}{15}$ and $\frac{3}{20}$.

$15 = 3 \times 5$
$20 = 4 \times 5$
$3 \times 4 \times 5 = 60$ *L.C.M.*

$\frac{7}{15} = \frac{28}{60}$
$\frac{3}{20} = \frac{9}{60}$
$\frac{37}{60}$ *sum.*

Oral

1. $\frac{1}{2}$ and $\frac{1}{4}$
2. $\frac{2}{3}$ and $\frac{1}{6}$
3. $\frac{1}{4}$ and $\frac{1}{3}$
4. $\frac{1}{4}$ and $\frac{3}{8}$
5. $\frac{1}{5}$ and $\frac{1}{3}$
6. $\frac{1}{2}$ and $\frac{1}{8}$
7. $\frac{1}{2}$ and $\frac{1}{5}$
8. $\frac{3}{4}$ and $\frac{1}{12}$
9. $\frac{1}{3}$ and $\frac{4}{9}$

A number is in its **simplest form** when (1) it is an integer, or (2) a proper fraction in its lowest terms, or (3) a mixed number whose fractional part is in its lowest terms.

Add, and reduce sums to simplest form:

10. $\frac{1}{4}, \frac{1}{5}, \frac{1}{6}$
11. $\frac{5}{8}, \frac{9}{10}, \frac{1}{2}$
12. $\frac{1}{4}, \frac{5}{6}, \frac{7}{8}$
13. $\frac{5}{8}, \frac{7}{10}, \frac{4}{5}$
14. $\frac{15}{24}, \frac{5}{12}, \frac{1}{16}$
15. $\frac{1}{4}, \frac{5}{6}, \frac{7}{8}$
16. $\frac{3}{10}, \frac{5}{12}$
17. $\frac{5}{8}, \frac{9}{10}, \frac{4}{5}$
18. $\frac{14}{35}, \frac{3}{7}, \frac{2}{5}$
19. $\frac{23}{24}, \frac{5}{8}, \frac{3}{16}$
20. $\frac{4}{5}, \frac{4}{9}$
21. $\frac{3}{7}, \frac{11}{12}$
22. $\frac{3}{4}, \frac{3}{5}, \frac{9}{10}$
23. $\frac{3}{8}, \frac{1}{4}, \frac{11}{12}$
24. $\frac{2}{9}, \frac{7}{15}, \frac{4}{5}$

25. Fred spent $\frac{1}{4}$ of his money for skates, $\frac{1}{8}$ for some paper, and $\frac{1}{2}$ for a book. What part of his money did he spend?

26. What is the sum of $\frac{1}{8}$ of a dollar, $\frac{1}{4}$ of a dollar, and $\frac{1}{5}$ of a dollar?

Find the sum of $2\frac{1}{4}$, $4\frac{1}{12}$, and $5\frac{3}{15}$.

$4 = 2 \times 2$
$12 = 2 \times 2 \times 3$
$15 = 3 \times 5$
$2 \times 2 \times 3 \times 5 = 60$ *L.C.M.*

$2\frac{1}{4} = 2\frac{15}{60}$
$4\frac{1}{12} = 4\frac{5}{60}$
$5\frac{3}{15} = 5\frac{12}{60}$
$11\frac{32}{60} = 11\frac{8}{15}$ *Sum*

Add:

1. $18\frac{1}{2}$ $16\frac{1}{6}$	**2.** $16\frac{1}{3}$ $19\frac{1}{6}$	**3.** $23\frac{1}{6}$ $98\frac{2}{3}$	**4.** $54\frac{1}{2}$ $16\frac{1}{3}$	**5.** $35\frac{1}{2}$ $42\frac{1}{3}$
6. $17\frac{2}{3}$ $15\frac{5}{6}$	**7.** $39\frac{1}{2}$ $89\frac{5}{6}$	**8.** $72\frac{5}{6}$ $81\frac{1}{2}$	**9.** $46\frac{1}{3}$ $89\frac{5}{6}$	**10.** $83\frac{2}{3}$ $10\frac{1}{2}$
11. $24\frac{1}{2}$ $12\frac{1}{6}$	**12.** $35\frac{1}{3}$ $19\frac{1}{6}$	**13.** $41\frac{1}{2}$ $18\frac{1}{3}$	**14.** $70\frac{5}{6}$ $18\frac{1}{2}$	**15.** $63\frac{2}{3}$ $12\frac{1}{2}$
16. $39\frac{5}{6}$ $12\frac{2}{3}$	**17.** $89\frac{2}{3}$ $29\frac{1}{2}$	**18.** $30\frac{5}{6}$ $19\frac{1}{3}$	**19.** $84\frac{1}{4}$ $19\frac{5}{8}$	**20.** $97\frac{5}{8}$ $16\frac{3}{4}$

Add:

21. $6\frac{5}{7}$, $3\frac{3}{14}$	**22.** $18\frac{7}{15}$, $10\frac{4}{5}$	**23.** $23\frac{5}{18}$, $16\frac{7}{9}$
24. $2\frac{5}{12}$, $16\frac{5}{6}$, $9\frac{2}{3}$	**25.** $4\frac{5}{9}$, $6\frac{3}{4}$, $7\frac{1}{2}$	**26.** $9\frac{1}{4}$, $7\frac{3}{8}$, $9\frac{1}{6}$
27. $18\frac{3}{8}$, $29\frac{7}{10}$	**28.** $162\frac{5}{9}$, $3\frac{1}{2}$	**29.** $38\frac{7}{16}$, $14\frac{1}{8}$, $7\frac{3}{4}$
30. $13\frac{7}{20}$, $16\frac{2}{5}$, $4\frac{3}{4}$	**31.** $7\frac{5}{8}$, $3\frac{7}{12}$, $5\frac{2}{3}$	**32.** $5\frac{4}{9}$, $6\frac{3}{5}$, 19
33. $15\frac{2}{3}$, $5\frac{4}{7}$, 11	**34.** $19\frac{3}{4}$, $\frac{2}{5}$, $5\frac{7}{8}$	**35.** $16\frac{5}{6}$, $14\frac{1}{7}$, $11\frac{2}{3}$
36. $239\frac{1}{5}$, $73\frac{6}{7}$	**37.** $386\frac{5}{7}$, $421\frac{5}{8}$	**38.** $18\frac{5}{9}$, 61, $34\frac{2}{5}$

39. $2\frac{1}{8}$ yards of cloth are required for a coat, $1\frac{1}{3}$ yards for trousers, and $\frac{3}{8}$ of a yard for a vest. How many yards are required for the whole suit?

40. Make problems from examples 1 to 5.

Problems

1. Henry sold three turkeys at Thanksgiving time. The first turkey weighed $8\frac{1}{2}$ pounds, the second $14\frac{1}{4}$ pounds, the third $16\frac{3}{4}$ pounds. Find the total weight of the three turkeys.

2. A farmer bought $2\frac{1}{4}$ tons of corn, $1\frac{3}{4}$ tons of bran, and $5\frac{1}{2}$ tons of corn meal. How many tons did he buy in all?

3. Add $18\frac{5}{8}$, $14\frac{1}{2}$, $12\frac{3}{4}$, and $16\frac{7}{8}$.

4. Mr. Cole worked $8\frac{1}{4}$ hours on Monday, $7\frac{3}{4}$ hours on Tuesday, $8\frac{1}{2}$ hours on Wednesday, $7\frac{1}{3}$ hours on Thursday, $8\frac{2}{3}$ hours on Friday, and 4 hours on Saturday. How many hours did he work during the week?

5. Mr. James travels $197\frac{2}{5}$ miles by auto on Monday and the same distance on Tuesday. On Wednesday he travels $212\frac{3}{5}$ miles. How far does he travel during the three days?

6. Taylor's Restaurant bought $6\frac{1}{2}$ pounds of veal, $7\frac{1}{4}$ pounds of beef, and $4\frac{1}{8}$ pounds of lamb for one meal. How many pounds of meat were bought?

7. A triangular plot measures $161\frac{7}{8}$ feet, $142\frac{1}{2}$ feet, and $129\frac{3}{4}$ feet on its three sides. How many feet around it?

8. Mr. Trapp sows $17\frac{3}{8}$ bushels of wheat, $21\frac{1}{2}$ bushels of barley, $14\frac{3}{4}$ bushels of corn, and $37\frac{3}{8}$ bushels of rye. How many bushels does he sow in all?

9. What is the sum of $80\frac{1}{2}$, $15\frac{1}{4}$, $61\frac{1}{2}$, and $3\frac{3}{4}$?

Fractions, to be subtracted, must be given a common denominator.

$\frac{3}{10} - \frac{2}{15} = ?$
$\frac{3}{10} = \frac{9}{30}$
$\frac{2}{15} = \frac{4}{30}$
$\frac{5}{30} = \frac{1}{6}$ *Difference*

Find the differences:

Oral

1. $\frac{3}{4} - \frac{1}{2}$
2. $\frac{7}{8} - \frac{3}{4}$
3. $\frac{8}{10} - \frac{2}{5}$
4. $\frac{5}{5} - \frac{1}{2}$
5. $\frac{7}{12} - \frac{1}{4}$
6. $\frac{7}{10} - \frac{3}{5}$
7. $\frac{3}{5} - \frac{1}{2}$
8. $\frac{5}{6} - \frac{1}{3}$
9. $\frac{1}{2} - \frac{1}{6}$
10. $\frac{9}{14} - \frac{2}{7}$
11. $\frac{2}{3} - \frac{3}{5}$
12. $\frac{1}{2} - \frac{1}{3}$

Written

13. $\frac{3}{5} - \frac{1}{4}$
14. $\frac{7}{8} - \frac{1}{3}$
15. $\frac{5}{6} - \frac{5}{8}$
16. $\frac{17}{18} - \frac{2}{9}$
17. $\frac{11}{15} - \frac{2}{5}$
18. $\frac{5}{6} - \frac{2}{5}$
19. $\frac{5}{6} - \frac{7}{12}$
20. $\frac{3}{4} - \frac{3}{5}$
21. $\frac{1}{6} - \frac{1}{8}$
22. $\frac{5}{6} - \frac{8}{15}$
23. $\frac{7}{10} - \frac{1}{15}$
24. $\frac{5}{9} - \frac{4}{15}$
25. $\frac{3}{8} - \frac{1}{10}$
26. $\frac{17}{20} - \frac{9}{30}$
27. $\frac{5}{8} - \frac{2}{5}$
28. $\frac{5}{6} - \frac{7}{9}$
29. $\frac{5}{8} - \frac{5}{12}$
30. $\frac{7}{12} - \frac{7}{24}$
31. $\frac{7}{8} - \frac{1}{6}$
32. $\frac{8}{9} - \frac{3}{4}$

33. Fred had $\frac{3}{4}$ of a dollar and spent $\frac{1}{5}$ of a dollar for a magazine. How much had he left?

34. Mother had $\frac{7}{8}$ of a pie. John and James ate $\frac{1}{4}$ of it. How much was left?

35. A dressmaker cut $\frac{3}{8}$ of a yard of velvet from a piece containing $\frac{15}{16}$ of a yard. What part was left?

36. Make problems for examples 1 to 12.

$$\begin{array}{r} 6 \\ 3\frac{1}{4} \\ \hline 2\frac{3}{4} \end{array}$$

Say "$\frac{1}{4}$ and $\frac{3}{4}$ (write $\frac{3}{4}$) = $\frac{4}{4}$ = 1
3 and 1 = 4
4 and 2 (write 2) = 6"

1. James had 3 oranges, and gave $\frac{1}{2}$ an orange to his sister. How many were left?

2. A 2-pound fish is how much heavier than a $\frac{1}{2}$-pound fish?

3. Mrs. A took 5 pints of milk, and Mrs. B took $\frac{1}{2}$ pint. Mrs. A took how much more than Mrs. B?

4. Helen has \$3 and Mary \$$1\frac{1}{4}$. Helen has how much more money than Mary?

Find the differences:

5. $9 - \frac{1}{2}$	6. $7 - \frac{1}{3}$	7. $6 - \frac{1}{4}$	8. $11 - \frac{1}{8}$	
9. $14 - \frac{2}{3}$	10. $15 - \frac{3}{4}$	11. $12 - 3\frac{3}{8}$	12. $16 - \frac{5}{8}$	
13. $12 - 2\frac{1}{2}$	14. $14 - 3\frac{1}{3}$	15. $15 - 3\frac{1}{6}$	16. $18 - 1\frac{1}{4}$	
17. $6 - 2\frac{1}{8}$	18. $5 - 1\frac{2}{3}$	19. $8 - 5\frac{3}{8}$	20. $9 - 2\frac{5}{8}$	
21. $6 - 2\frac{1}{8}$	22. $12 - 3\frac{1}{7}$	23. $14 - 8\frac{2}{7}$	24. $12 - 11\frac{7}{8}$	

25. $\begin{array}{r} 83 \\ 17\frac{1}{2} \\ \hline \end{array}$	26. $\begin{array}{r} 48 \\ 19\frac{1}{4} \\ \hline \end{array}$	27. $\begin{array}{r} 631 \\ 29\frac{3}{4} \\ \hline \end{array}$	28. $\begin{array}{r} 7 \\ 2\frac{3}{8} \\ \hline \end{array}$	29. $\begin{array}{r} 431 \\ 231\frac{1}{5} \\ \hline \end{array}$
30. $\begin{array}{r} 423 \\ 192\frac{1}{3} \\ \hline \end{array}$	31. $\begin{array}{r} 69 \\ 58\frac{5}{6} \\ \hline \end{array}$	32. $\begin{array}{r} 29 \\ 9\frac{3}{7} \\ \hline \end{array}$	33. $\begin{array}{r} 401 \\ 300\frac{2}{3} \\ \hline \end{array}$	34. $\begin{array}{r} 43 \\ 18\frac{3}{5} \\ \hline \end{array}$
35. $\begin{array}{r} 61 \\ \frac{4}{18} \\ \hline \end{array}$	36. $\begin{array}{r} 46 \\ 1\frac{5}{8} \\ \hline \end{array}$	37. $\begin{array}{r} 29 \\ 14\frac{7}{10} \\ \hline \end{array}$	38. $\begin{array}{r} 13 \\ 5\frac{5}{11} \\ \hline \end{array}$	39. $\begin{array}{r} 16 \\ 15\frac{19}{20} \\ \hline \end{array}$

$8\frac{1}{3} = 8\frac{2}{6}$
$5\frac{1}{2} = 5\frac{3}{6}$
$2\frac{5}{6}$

Say "$\frac{3}{6}$ and $\frac{5}{6}$ (write $\frac{5}{6}$) $= \frac{8}{6}$ $(1\frac{2}{6})$
5 and 1 $= 6$
6 and 2 (write 2) $= 8$"

Find the differences:

1. $3\frac{1}{3} - \frac{3}{5}$

2. $6\frac{1}{2} - 4\frac{2}{3}$

3. $\frac{1}{7} - \frac{1}{8}$

4. $\frac{7}{8} - \frac{7}{12}$

5. $2\frac{7}{40} - \frac{3}{8}$

6. $8\frac{1}{7} - 5\frac{1}{2}$

7. $210\frac{1}{2} - 109\frac{5}{9}$

8. $12\frac{1}{5} - 5\frac{1}{3}$

9. $42\frac{3}{5} - 33\frac{5}{7}$

10. $198\frac{3}{5} - 49\frac{2}{3}$

11. $7\frac{2}{3} - 5\frac{4}{5}$

12. $46\frac{3}{5} - 27\frac{4}{5}$

13. $867\frac{2}{3} - 476\frac{3}{4}$

14. $32\frac{1}{3} - 26\frac{2}{3}$

15. $13\frac{7}{10} - 3\frac{7}{20}$

16. $481\frac{1}{10} - 232\frac{7}{10}$

17. $3\frac{7}{8} - 2\frac{8}{9}$

18. $16\frac{2}{3} - 8\frac{5}{6}$

19. $862\frac{5}{9} - 46\frac{7}{9}$

20. $230\frac{1}{2} - 140\frac{1}{4}$

21. $89\frac{7}{9} - 43\frac{1}{2}$

22. $807\frac{2}{3} - 298\frac{1}{3}$

23. $190\frac{2}{5} - 28\frac{3}{5}$

24. $281\frac{4}{11} - 37\frac{1}{2}$

25. From a barrel containing $31\frac{1}{2}$ gal. of vinegar $12\frac{3}{4}$ gal. were sold. How many gallons remained?

26. How many inches must be cut from a stick $12\frac{5}{8}$ in. long to leave it $9\frac{3}{4}$ in. long?

27. If from $16\frac{3}{4}$ bushels of grain $12\frac{5}{8}$ bushels are used, how much is left?

28. From a cheese weighing $52\frac{1}{2}$ pounds $24\frac{3}{4}$ pounds were sold. How many pounds remained?

29. John walked $3\frac{1}{2}$ miles and then rode $12\frac{1}{4}$ miles. How much farther did he ride than he walked?

30. Charles is $4\frac{7}{12}$ ft. tall. Henry is $5\frac{1}{2}$ ft. tall. How much taller is Henry than Charles?

5	Say "$\frac{1}{3}$ and $\frac{2}{3}$ (write $\frac{2}{3}$) $= \frac{3}{3} = 1$
$2\frac{1}{3}$	2 and 1 are 3
$2\frac{2}{3}$ *Difference*	3 and 2 (write 2) $= 5$"

1. William bought 5 bushels of berries. He sold $3\frac{1}{4}$ bushels. How many bushels did he have left?

2. Mary had a piece of ribbon 24 inches long. She used $22\frac{1}{2}$ inches of it. How many inches were left?

3. Mr. Smith had 86 bushels of onions. He sold $39\frac{1}{4}$ bushels. How many bushels remained?

4. A milkman bought 127 quarts of milk and sold $98\frac{1}{2}$ quarts. How many quarts had he left?

5. What number must be added to $12\frac{2}{3}$ to make 32?

6. An auto radiator holds 22 quarts. In it there were poured $7\frac{1}{2}$ quarts of alcohol to keep it from freezing. How much water must be added to fill it?

7. I traveled by auto 317 miles in two days. The first day I traveled $162\frac{3}{4}$ miles. How many miles did I travel the second day?

8. From a can containing five gallons of oil $1\frac{1}{2}$ gallons are sold. How many gallons are left in the can?

9. What must be added to $\frac{7}{8}$ of a ton to make two tons?

10. Subtract $\$96\frac{3}{4}$ from $\$200$.

11. From a car containing 40 tons of coal, $16\frac{3}{4}$ tons are sold. How many tons are not sold?

12. From $\$90$ subtract $\$16\frac{1}{4}$.

$$\begin{array}{r} 7\frac{1}{2} \\ \frac{5}{8} \\ \hline 6\frac{7}{8} \end{array}$$

Say "$\frac{5}{8}$ and $\frac{7}{8}$ (write $\frac{7}{8}$) = $\frac{1}{8}$ ($1\frac{1}{2}$)
1 and 6 (write 6) = 7."

1. A fish weighing $3\frac{3}{4}$ pounds when caught, dressed away $1\frac{7}{8}$ pounds. How much did it weigh dressed?

2. What number must be added to $8\frac{7}{8}$ to make $22\frac{1}{4}$?

3. In a shipment of seed corn containing $184\frac{3}{4}$ bushels, $24\frac{1}{2}$ bushels were found damaged. How many bushels were good?

4. A butcher buys $671\frac{1}{2}$ pounds of beef and sells $189\frac{7}{8}$ pounds. How many pounds has he left?

5. What number must be added to $136\frac{1}{2}$ to make $301\frac{3}{5}$?

6. Of $37\frac{5}{8}$ miles of copper wire, $11\frac{3}{4}$ miles are large and the remainder small. How many miles are small?

7. In a vat that will hold $22\frac{1}{2}$ barrels there are $11\frac{5}{6}$ barrels of soap. How many more barrels will it hold?

8. From a stick $16\frac{1}{2}$ feet long, two pieces are cut. One piece is $4\frac{1}{2}$ feet and the other is $6\frac{3}{4}$ feet. What was the length of the remaining piece?

9. The total thickness of three boards is 4 inches. One is $\frac{3}{4}$ of an inch thick, another is $1\frac{3}{8}$ inches. What is the thickness of the third?

10. From a pile of $27\frac{7}{8}$ cords of wood $17\frac{1}{2}$ cords are sold. How many cords remain?

11. There are 100 bushels of apples in three piles. The first contains $26\frac{3}{4}$ bushels, and the second $49\frac{1}{2}$ bushels. Find the number of bushels in the third pile.

12. A bin holds $87\frac{1}{2}$ bushels of corn. From it are selected $49\frac{1}{4}$ bushels for seed. How many bushels remain?

13. $800\frac{3}{8} - 601\frac{1}{4} = ?$

14. Subtract $12\frac{3}{4}$ from $20\frac{2}{5}$.

15. Peter is $5\frac{7}{8}$ feet tall. Walter is $5\frac{1}{4}$ feet tall. How much taller is Peter than Walter?

16. A turkey which weighed $12\frac{1}{8}$ pounds two months ago weighs $18\frac{1}{4}$ pounds now. How much has it increased in weight?

17. Robert walked $18\frac{1}{2}$ miles in three days. He walked $5\frac{2}{3}$ miles the first day, and $6\frac{1}{4}$ miles the second day. How many miles did he walk the third day?

18. A triangle measures $101\frac{1}{8}$ feet on its three sides. The sum of two sides is $72\frac{1}{2}$ feet. How long is the third side?

19. Mr. Jones draws $168\frac{1}{2}$ dollars from his bank deposit of $361\frac{3}{4}$ dollars. How much has he remaining in the bank?

20. At high water a river is $17\frac{7}{12}$ feet deep. At low water it is $12\frac{3}{4}$ feet deep. How much is the increase from low to high water?

21. From $100\frac{1}{4}$ subtract the sum of $21\frac{3}{4}$, $30\frac{1}{2}$, and $26\frac{2}{3}$.

22. Mr. Smith is able to go down town by two different routes. One route measures $\frac{3}{4}$ of a mile. The other measures $1\frac{3}{8}$ miles. How much farther is one route than the other?

23. Roy walks $226\frac{1}{2}$ feet in going from one corner to the diagonally opposite corner of a lot. In walking on the two sides between the same two points, he travels $175\frac{3}{4}$ feet on one side and $91\frac{5}{8}$ feet on the other side. Which way is shorter and how much? *Picture it.*

24. Peter weighs $134\frac{1}{4}$ pounds. Walter weighs $62\frac{3}{4}$ pounds. How many pounds heavier is Peter than Walter?

25. Mr. Coy raised 865 bushels of potatoes on three fields. On the first he raised $261\frac{1}{4}$ bushels. On the second he raised $344\frac{1}{2}$ bushels. How many bushels did he raise on the third field?

26. Add $47\frac{9}{12}$, $62\frac{3}{4}$, $50\frac{2}{3}$, and $79\frac{1}{2}$, and from the sum take $199\frac{3}{4}$.

27. A bin will hold 16 tons of coal. Seven loads with the following weights have been placed in the bin: $2\frac{1}{4}$ tons, $1\frac{3}{4}$ tons, $2\frac{1}{8}$ tons, $1\frac{7}{8}$ tons, $1\frac{1}{2}$ tons, $1\frac{1}{4}$ tons, and $2\frac{3}{8}$ tons. How many tons will be required to fill the bin?

28. Subtract $8\frac{3}{4}$ inches from $10\frac{1}{8}$ inches.

29. What must be added to $12\frac{1}{3}$ yd. to make $15\frac{3}{4}$ yd.?

30. From the sum of $7\frac{3}{5}$ and $9\frac{1}{3}$ subtract $11\frac{1}{4}$.

31. Change $\frac{3}{7}$ to 35ths.

32. Subtract $11\frac{3}{7}$ from $21\frac{1}{3}$.

33. George earned $\$2\frac{1}{4}$ selling papers, $\$\frac{9}{10}$ mowing a lawn, and $\$1\frac{1}{2}$ delivering milk. How much more must he earn to make \$5?

Review

1. How many cents are there in $\frac{1}{2}$ of a dollar?

2. How does $\frac{1}{2}$ compare with $\frac{1}{4}$? Show this by a drawing.

3. Which is larger, $\frac{1}{3}$ of an apple or $\frac{1}{2}$ of an apple? $\frac{6}{12}$ or $\frac{1}{2}$? $\frac{2}{3}$ or $\frac{6}{9}$?

4. Which is greater, $\frac{2}{3}$ or $\frac{3}{5}$?

5. Name all of the numbers that are exactly contained in 12; in 14; in 15; in 16; in 18.

6. Name all of the numbers of which 24 is a multiple.

7. A fraction always indicates what operation?

8. Give the prime factors of 15; 21; 18; 24.

9. Add $\frac{1}{2}$ and $\frac{1}{4}$; $\frac{3}{4}$ and $\frac{1}{2}$; $\frac{5}{6}$ and $\frac{2}{6}$.

10. Henry bought a top for 3 cents, some candy for 11 cents, and a pencil for 7 cents. What change should he receive from a quarter?

11. \$240 will buy how many typewriters at \$60 apiece?

12. How many 4ths are there in 6 apples? In 8 apples? In $\frac{1}{2}$ an apple?

13. How many 8ths are there in 5? In 9? In $\frac{1}{4}$?

14. How many 6ths are there in $\frac{1}{2}$? In $\frac{2}{3}$?

15. Reduce to lowest terms:

$$\frac{6}{12};\ \frac{4}{6};\ \frac{15}{20};\ \frac{8}{12};\ \frac{12}{15}.$$

16. Change $\frac{1}{2}$ to 8ths; $\frac{1}{3}$ to 12ths; $\frac{1}{3}$ to 9ths.

17. Reduce to whole or mixed numbers:

$$\frac{9}{4};\ \frac{7}{3};\ \frac{5}{2};\ \frac{24}{12};\ \frac{8}{2};\ \frac{10}{7}.$$

18. Change to mixed numbers: $\frac{82}{9}$; $\frac{45}{8}$; $\frac{32}{9}$; $\frac{61}{3}$; $\frac{87}{12}$.

19. From $12\frac{3}{4}$ subtract $5\frac{7}{8}$.

20. Change 4 to 4ths.

Cancellation

The solution of examples in division is often shortened by striking out the same factor from both dividend and divisor. This process is called **cancellation.**

	The Long Way	Cancellation
$\frac{4 \times 6}{3} = ?$	$4 \times 6 = 24$ $24 \div 3 = 8$	$\frac{4 \times \cancel{6}^{2}}{\cancel{3}} = 8$
$\frac{4 \times 9}{2 \times 3} = ?$	$4 \times 9 = 36$ $2 \times 3 = 6$ $36 \div 6 = 6$	$\frac{\cancel{2}\,\cancel{4} \times \cancel{9}^{3}}{\cancel{2} \times \cancel{3}} = 6$

Solve by cancellation:

1.	$\frac{4 \times 3}{2}$	7.	$\frac{35 \times 3}{7}$	13.	$\frac{17 \times 14}{7 \times 17}$	19.	$\frac{45 \times 17}{17 \times 9}$
2.	$\frac{6 \times 5}{3}$	8.	$\frac{33 \times 7}{11}$	14.	$\frac{23 \times 22}{11 \times 23}$	20.	$\frac{14 \times 22}{7 \times 11}$
3.	$\frac{6 \times 7}{2}$	9.	$\frac{39 \times 5}{3}$	15.	$\frac{27 \times 35}{5 \times 9}$	21.	$\frac{21 \times 33}{7 \times 11}$
4.	$\frac{9 \times 7}{3}$	10.	$\frac{6 \times 10}{3 \times 5}$	16.	$\frac{15 \times 28}{5 \times 7}$	22.	$\frac{21 \times 39}{13 \times 3}$
5.	$\frac{14 \times 7}{7}$	11.	$\frac{7 \times 24}{7 \times 8}$	17.	$\frac{15 \times 35}{3 \times 7}$	23.	$\frac{39 \times 44}{11 \times 13}$
6.	$\frac{21 \times 5}{7}$	12.	$\frac{11 \times 18}{9 \times 11}$	18.	$\frac{20 \times 13}{13 \times 5}$	24.	$\frac{34 \times 49}{7 \times 17}$

$\frac{15 \times 22}{11 \times 10} = ?$	THE LONG WAY	CANCELLATION
	$15 \times 22 = 330$ $11 \times 10 = 110$ $330 \div 110 = 3$	$\frac{\overset{3}{\cancel{15}} \times \overset{2}{\cancel{22}}}{\underset{1}{\cancel{11}} \times \underset{1}{\cancel{10}}} = 3$ $\cancel{5}$

Solve, using cancellation:

1. $\frac{25 \times 14}{7 \times 10}$ **7.** $\frac{50 \times 26}{20 \times 13}$ **13.** $\frac{60 \times 77}{21 \times 5}$ **19.** $\frac{24}{3 \times 4}$

2. $\frac{21 \times 24}{12 \times 14}$ **8.** $\frac{44 \times 30}{33 \times 8}$ **14.** $\frac{81 \times 56}{36 \times 63}$ **20.** $\frac{75}{15 \times 5}$

3. $\frac{28 \times 18}{3 \times 21}$ **9.** $\frac{36 \times 14}{24 \times 21}$ **15.** $\frac{25 \times 66}{55 \times 15}$ **21.** $\frac{144}{6 \times 24}$

4. $\frac{35 \times 36}{6 \times 15}$ **10.** $\frac{99 \times 40}{10 \times 22}$ **16.** $\frac{15 \times 72}{18 \times 30}$ **22.** $\frac{162}{3 \times 6 \times 9}$

5. $\frac{66 \times 15}{3 \times 30}$ **11.** $\frac{45 \times 36}{12 \times 27}$ **17.** $\frac{21 \times 54}{9 \times 42}$ **23.** $\frac{378}{7 \times 6 \times 9}$

6. $\frac{36 \times 33}{11 \times 27}$ **12.** $\frac{32 \times 90}{12 \times 40}$ **18.** $\frac{42 \times 45}{54 \times 7}$ **24.** $\frac{504}{7 \times 8 \times 9}$

25. Divide 46×63 by 7×23.

26. Divide 35×21 by 7×7.

27. Divide 55×84 by 7×11.

28. Divide 39×56 by 7×13.

29. Divide 34×46 by 23×17.

30. Divide $3 \times 26 \times 15$ by $5 \times 13 \times 3$.

Analysis

1. $8 \times ? = 48.$

STATEMENT, $\frac{48}{8} = ?$ SOLUTION, $\overset{6}{\frac{\cancel{48}}{\cancel{8}}} = 6$ *Ans.*

2. $? \times 6 = 72.$

STATEMENT, $\frac{72}{6} = ?$ SOLUTION, $\overset{12}{\frac{\cancel{72}}{\cancel{6}}} = 12$ *Ans.*

3. $4 \times 8 \times ? = 64.$

STATEMENT, $\frac{64}{4 \times 8} = ?$ SOLUTION, $\overset{2}{\frac{\cancel{64}}{\cancel{4} \times \cancel{8}}} = 2$ *Ans.*

4. The product of three numbers is 640. One of them is 4 and another is 16. What is the third?

STATEMENT, $\frac{640}{4 \times 16} = ?$ SOLUTION, $\overset{10}{\frac{\cancel{160}}{\cancel{640}}} = 10$ *Ans.*

State and solve:

5. $5 \times 3 \times ? = 60.$

6. $8 \times ? \times 4 = 384.$

7. $? \times 7 \times 3 = 189.$

8. $5 \times 9 \times ? = 225.$

9. Given product 1080; factors 6, 15. Find missing factor.

10. If 3 watches cost \$20, what will 9 watches cost?

STATEMENT, $\frac{9 \times 20}{3} = ?$ SOLUTION, $\overset{3}{\frac{\cancel{9} \times \$20}{\cancel{3}}} = \$60.$

Make statements, and solve by cancellation:

11. If 8 bicycles cost \$280, what will 3 cost?

12. If 7 hats cost \$21, what will 10 cost?

13. If 4 rugs cost \$124, what will 10 cost?

1. Divide 7×4 by 3×7.

2. Divide 9×1 by 5×3.

3. Divide 12×8 by 4×6.

4. Divide 5×16 by 4×20.

5. If 12 books cost \$4, what will 6 books cost?

6. It costs 18 cents an hour to burn 24 electric lights. What will it cost to burn six of these lights for one hour?

7. A class of 9 pupils use 63 sheets of drawing paper. How many sheets of drawing paper will a class of 45 pupils require?

8. When oranges are sold at the rate of 8 for 48 cents, what is the price per dozen?

9. What would be the cost of 30 eggs at 60 cents per dozen?

10. Mr. Williams sold 5 T of cabbage for \$80. At that rate, what would a carload of 22 T be worth?

11. If 40 quarts of milk weigh 85 pounds, what will be the weight of 100 quarts?

12. Mr. Foster worked 3 days for Mr. Brown and charged him \$18. He then worked 7 days for Mr. Card. At the same rate, what should Mr. Card pay Mr. Foster?

13. Mr. Cole considers a pile of wood 4 ft. high and 8 ft. long a cord. How many such cords would there be in a pile 6 ft. high and 32 ft. long?

14. Mr. Sharpe sells 3 grapefruit for 25¢. At that rate what will he receive for two dozen?

Multiplication of Fractions

The product of a fraction and an integer.

$9 \times \frac{2}{3} = ?$
9 times 2 *thirds* = 18 *thirds*
$\frac{18}{3} = 6$

Oral. Give the products:

1. $3 \times \frac{1}{4}$	**5.** $5 \times \frac{4}{5}$	**9.** $8 \times \frac{3}{5}$	**13.** $4 \times \frac{5}{7}$
2. $5 \times \frac{1}{5}$	**6.** $4 \times \frac{2}{3}$	**10.** $7 \times \frac{2}{9}$	**14.** $10 \times \frac{5}{8}$
3. $2 \times \frac{3}{4}$	**7.** $7 \times \frac{1}{9}$	**11.** $5 \times \frac{1}{6}$	**15.** $3 \times \frac{7}{8}$
4. $8 \times \frac{1}{9}$	**8.** $6 \times \frac{5}{8}$	**12.** $7 \times \frac{3}{5}$	**16.** $6 \times \frac{2}{3}$

$4 \times \frac{9}{12}$ gives the same product as $\frac{9}{12} \times 4$. According to Prin. 1 we may multiply the numerator, $\frac{4 \times 9}{12} = \frac{36}{12}$. $\frac{36}{12} = 3$. We may sometimes solve by cancellation.

$$\frac{\overset{3}{\cancel{4}} \times 9}{\underset{3}{\cancel{12}}} = 3.$$

$\frac{9}{12}$ of 4 means the same as $\frac{9}{12} \times 4$.

Written. Find the products:

1. $14 \times \frac{5}{7}$	**7.** $13 \times \frac{14}{39}$	**13.** $\frac{6}{7}$ of 84
2. $24 \times \frac{9}{12}$	**8.** $7 \times \frac{36}{84}$	**14.** $\frac{14}{15}$ of 90
3. $8 \times \frac{9}{16}$	**9.** $24 \times \frac{7}{8}$	**15.** $\frac{14}{25}$ of 75
4. $15 \times \frac{2}{30}$	**10.** $44 \times \frac{9}{11}$	**16.** $\frac{17}{18} \times 45$
5. $14 \times \frac{11}{28}$	**11.** $81 \times \frac{2}{27}$	**17.** $\frac{7}{24}$ of 30
6. $5 \times \frac{28}{35}$	**12.** $63 \times \frac{14}{27}$	**18.** $\frac{8}{14}$ of 21

Multiplying a Fraction by a Fraction

$$\frac{2}{3} \times \frac{9}{10} = ?$$

Since 2 and 9 are dividends and
3 and 10 are divisors.

The example may be stated $\frac{2 \times 9}{3 \times 10} = ?$

Take the product of the numerators for a new numerator and the product of the denominators for a new denominator.

Cancellation may be used thus: $\frac{\overset{1}{\cancel{2}} \times \overset{3}{\cancel{9}}}{\underset{1}{\cancel{3}} \times \underset{5}{\cancel{10}}} = \frac{3}{5}$

$\frac{2}{3}$ of $\frac{9}{10}$ means the same as $\frac{2}{3} \times \frac{9}{10}$.

Oral

1. $\frac{1}{4}$ of $\frac{1}{2} = ?$
2. $\frac{1}{3}$ of $\frac{1}{4} = ?$
3. $\frac{2}{3}$ of $\frac{1}{2} = ?$
4. $\frac{1}{2} \times \frac{1}{3} = ?$
5. $\frac{1}{5} \times \frac{1}{4} = ?$
6. $\frac{1}{4} \times \frac{2}{3} = ?$
7. $\frac{1}{4}$ of $\frac{1}{4} = ?$
8. $\frac{1}{3}$ of $\frac{3}{4} = ?$
9. $\frac{1}{6} \times \frac{1}{5} = ?$
10. $\frac{2}{3}$ of $\frac{1}{5} = ?$
11. $\frac{2}{5} \times \frac{1}{2} = ?$
12. $\frac{3}{5}$ of $\frac{1}{3} = ?$
13. $\frac{1}{5}$ of $\frac{2}{3} = ?$
14. $\frac{1}{4} \times \frac{1}{5} = ?$
15. $\frac{2}{3}$ of $\frac{3}{4} = ?$

Written. Find the products:

16. $\frac{5}{8} \times \frac{4}{5}$
17. $\frac{3}{7}$ of $\frac{14}{15}$
18. $\frac{7}{8} \times \frac{4}{5}$
19. $\frac{5}{16}$ of $\frac{8}{9}$
20. $\frac{13}{15} \times \frac{5}{8}$
21. $\frac{2}{7} \times \frac{14}{15}$
22. $\frac{3}{8}$ of $\frac{8}{9}$
23. $\frac{7}{16}$ of $\frac{12}{21}$
24. $\frac{5}{6} \times \frac{7}{15}$
25. $\frac{11}{12} \times \frac{8}{9}$
26. $\frac{3}{4}$ of $\frac{5}{6}$
27. $\frac{7}{8} \times \frac{3}{5}$
28. $\frac{4}{5} \times \frac{6}{7}$
29. $\frac{8}{9} \times \frac{11}{12}$
30. $\frac{4}{5}$ of $\frac{3}{32}$
31. $\frac{25}{32} \times \frac{4}{5}$
32. $\frac{12}{13} \times \frac{1}{24}$
33. $\frac{3}{8}$ of $\frac{5}{6}$
34. $\frac{5}{7}$ of $\frac{7}{15}$
35. $\frac{5}{9} \times \frac{7}{8}$
36. $\frac{2}{3}$ of $\frac{15}{32}$

$$1\tfrac{2}{3} \times 8\tfrac{1}{2} \times \tfrac{5}{17} \times 4 = \ ?$$

Mixed numbers may be reduced to improper fractions and then multiplied; thus,

Solution: $\frac{5}{3} \times \frac{\overset{1}{\cancel{17}}}{\underset{1}{2}} \times \frac{5}{\underset{1}{\cancel{17}}} \times \frac{\overset{2}{\cancel{4}}}{1} = \frac{50}{3}$. $\frac{50}{3} = 16\frac{2}{3}$.

Written

1. $4\frac{3}{4} \times 5\frac{1}{2}$
2. $11\frac{9}{11} \times 7\frac{1}{3}$
3. $177\frac{2}{3} \times 3$
4. $4\frac{1}{2} \times 7\frac{2}{3}$
5. $5\frac{2}{3} \times 8\frac{6}{7} \times \frac{5}{17}$
6. $5\frac{3}{4} \times 2\frac{4}{5} \times 20$
7. $7\frac{1}{2} \times 5\frac{4}{9} \times \frac{3}{7}$
8. $35\frac{4}{5} \times 27\frac{8}{9}$
9. $28\frac{1}{2} \times 17\frac{3}{5}$
10. $40\frac{2}{3} \times 5\frac{1}{4}$
11. $\frac{3}{11} \times 25\frac{2}{3} \times \frac{5}{8}$
12. $3\frac{1}{2} \times 9\frac{1}{7} \times 6\frac{5}{6}$
13. $9\frac{1}{4} \times \frac{4}{37} \times 2\frac{1}{5}$
14. $6\frac{1}{4} \times \frac{11}{25} \times \frac{5}{11}$

15. Mrs. Arnold buys $3\frac{1}{2}$ qt. of milk a day. What does she pay for it at 10¢ a quart?

16. How far does Joe ride in $3\frac{1}{2}$ hours if he rides $9\frac{1}{2}$ miles an hour?

17. Find the value of $21\frac{3}{4}$ chests of tea, each weighing $57\frac{1}{2}$ lb., at 40¢ per pound.

18. At $\$12\frac{1}{2}$ a ton, how much will $9\frac{3}{20}$ tons of hay cost?

19. At $\$13\frac{1}{2}$ a ton what will $11\frac{1}{4}$ tons of coal cost?

20. Mr. Reynolds sold $16\frac{1}{2}$ bushels of potatoes at $\frac{3}{4}$ of a dollar a bushel. How much did he receive for the potatoes?

1. $12 \times 4\frac{2}{3} = ?$
2. $24 \times 2\frac{3}{4} = ?$
3. $36 \times 3\frac{5}{9} = ?$
4. $45 \times 5\frac{2}{5} = ?$
5. $49 \times 3\frac{3}{7} = ?$
6. $18 \times 5\frac{1}{6} = ?$
7. $16 \times 6\frac{7}{8} = ?$
8. $8 \times 3\frac{1}{4} = ?$
9. $6 \times 10\frac{2}{3} = ?$
10. $15 \times 9\frac{4}{5} = ?$
11. $22 \times 2\frac{2}{11} = ?$
12. $20 \times 5\frac{3}{4} = ?$
13. $14 \times 3\frac{2}{7} = ?$
14. $9 \times 10\frac{2}{3} = ?$
15. $25 \times 5\frac{1}{5} = ?$
16. $4 \times 25\frac{1}{4} = ?$
17. $10 \times 16\frac{3}{5} = ?$
18. $30 \times 5\frac{5}{6} = ?$
19. $15 \times 6\frac{3}{5} = ?$
20. $29 \times 12\frac{2}{3} = ?$
21. $12\frac{1}{4} \times 2 = ?$
22. $18\frac{1}{9} \times 3 = ?$
23. $6\frac{3}{4} \times 8 = ?$
24. $7\frac{2}{3} \times 6 = ?$
25. $8\frac{3}{5} \times 5 = ?$
26. $9\frac{5}{8} \times 4 = ?$
27. $27\frac{5}{6} \times 3 = ?$
28. $15\frac{2}{3} \times 9 = ?$
29. $19\frac{4}{5} \times 10 = ?$
30. $6\frac{2}{3} \times 12 = ?$
31. $19\frac{2}{5} \times 10 = ?$
32. $8\frac{7}{8} \times 8 = ?$
33. $9\frac{5}{6} \times 12 = ?$
34. $8\frac{4}{5} \times 15 = ?$
35. $9\frac{3}{4} \times 20 = ?$
36. $6\frac{24}{25} \times 25 = ?$
37. $8\frac{15}{16} \times 16 = ?$
38. $6\frac{4}{7} \times 14 = ?$
39. $11\frac{8}{9} \times 9 = ?$
40. $9\frac{10}{11} \times 22 = ?$

41. Mr. Wilson pays for labor at the rate of 50 cents an hour for a $9\frac{1}{2}$-hour day. What does the day's work cost him?

42. Ralph earns $2\frac{3}{4}$ dollars a day. How much money will he earn in 24 days?

43. Find the weight of 50 turkeys if the average weight of each is $17\frac{7}{8}$ pounds.

Review

1. $\frac{1}{4} + \frac{7}{8} = ?$
2. $\frac{1}{4} \times \frac{5}{8} = ?$
3. $\frac{5}{8} - \frac{1}{4} = ?$
4. $\frac{1}{2} + \frac{1}{3} = ?$
5. $\frac{1}{4} \times \frac{1}{2} = ?$
6. $\frac{1}{2} - \frac{3}{8} = ?$
7. $\frac{1}{7} + \frac{1}{2} = ?$
8. $\frac{1}{8} \times \frac{1}{2} = ?$
9. $\frac{1}{3} - \frac{1}{8} = ?$
10. $3\frac{1}{2} \times 2\frac{4}{5} = ?$
11. $3\frac{1}{2} - 2\frac{4}{5} = ?$
12. $3\frac{1}{2} + 2\frac{4}{5} = ?$
13. $\frac{4}{5} + \frac{1}{3} = ?$
14. $\frac{4}{5} - \frac{1}{3} = ?$
15. $\frac{1}{3} \times \frac{4}{5} = ?$
16. $2\frac{3}{8} \times \frac{1}{2} = ?$
17. $3\frac{3}{4} + \frac{1}{8} = ?$
18. $4\frac{3}{5} - \frac{1}{4} = ?$
19. $3\frac{1}{8} \times \frac{1}{3} = ?$
20. $1\frac{1}{9} \times \frac{1}{3} = ?$
21. $2\frac{2}{9} - \frac{2}{3} = ?$
22. $3\frac{1}{7} + \frac{2}{3} = ?$
23. $2\frac{2}{5} - \frac{1}{4} = ?$
24. $\frac{1}{9} \times \frac{1}{3} = ?$
25. $\frac{1}{3} - \frac{1}{4} = ?$
26. $1\frac{4}{5} + \frac{8}{9} = ?$
27. $7\frac{7}{9} - \frac{4}{5} = ?$
28. $\frac{7}{9} \times \frac{3}{7} = ?$
29. $\frac{4}{5} \times 1\frac{1}{4} = ?$
30. $\frac{1}{3} \times \frac{1}{4} = ?$
31. $\frac{5}{6} \times \frac{3}{2} = ?$
32. $\frac{5}{6} \times \frac{2}{5} = ?$
33. $5\frac{1}{3} \times \frac{1}{4} = ?$
34. $3\frac{5}{7} \times \frac{7}{8} = ?$
35. $3\frac{1}{2} \times \frac{2}{7} = ?$
36. $\frac{1}{4} \times \frac{7}{8} = ?$
37. $7\frac{1}{10} \times 6\frac{1}{5} = ?$
38. $3\frac{1}{7} + 2\frac{1}{4} = ?$
39. $2\frac{1}{5} - \frac{3}{7} = ?$
40. $20\frac{1}{8} \times \frac{1}{4} = ?$
41. $18\frac{1}{9} \times \frac{1}{3} = ?$
42. $16\frac{1}{5} - \frac{3}{4} = ?$
43. $8\frac{3}{4} \times \frac{1}{5} = ?$
44. $1\frac{7}{8} - \frac{3}{4} = ?$
45. $\frac{2}{5} \times 5 = ?$
46. $8\frac{1}{3} \times \frac{4}{5} = ?$
47. $\frac{3}{5} \times \frac{1}{6} = ?$
48. $\frac{5}{9} + \frac{1}{7} = ?$
49. $7\frac{3}{5} - \frac{4}{5} = ?$
50. $3\frac{3}{8} + 2\frac{5}{9} = ?$

Product and Factors

When two factors are given, we *multiply* either one by the other to find their *product.*

E.g. 8 and 9 are factors of 72; $8 \times 9 = 72$, or $9 \times 8 = 72$.

When a *product* and *one of its factors* are given, we divide the product by the given factor to find the *other factor.*

E.g. $8 \times ? = 72$; $72 \div 8 = 9$.
$? \times 9 = 72$; $72 \div 9 = 8$.

What is given? What is to be found? Give the answer.

1. $12 \times ? = 60$
2. $12 \times 12 = ?$
3. $6 \times ? = 48$
4. $? \times 5 = 40$
5. $11 \times ? = 132$
6. $8 \times ? = 72$
7. $? \times 9 = 81$
8. $7 \times 9 = ?$
9. $7 \times ? = 56$
10. $8 \times 4 = ?$
11. $? \times 10 = 60$
12. $7 \times 6 = ?$
13. $5 \times 5 = ?$
14. $? \times 7 = 35$
15. $? \times 12 = 108$
16. $6 \times ? = 36$
17. $5 \times ? = 45$
18. $2 \times ? = 32$
19. $? \times 4 = 60$
20. $5 \times ? = 100$
21. $? \times 4 = 100$
22. $12 \times ? = 120$
23. $10 \times 10 = ?$
24. $3 \times 30 = ?$

Make a problem for each of the above.

25. Donald earned 90¢, and saved 60¢ of it. What part of his money did he save?

26. If three balls cost $\$3\frac{3}{4}$, find the cost of one.

27. What part of 15 is 3?

28. Find the cost of one dozen chairs at $\$2\frac{1}{4}$ each.

1. $20 \times 10 = ?$
2. $16 \times 5 = ?$
3. $30 \times ? = 90$
4. $16 \times ? = 64$
5. $? \times 15 = 75$
6. $? \times 35 = 140$
7. $? \times 9 = 72$
8. $16 \times ? = 96$
9. $22 \times 11 = ?$
10. $? \times 12 = 72$
11. $17 \times ? = 85$
12. $42 \times 6 = ?$

13. Seventeen men earn daily 7 dollars each. Find their total pay for one day.

Statement. 17 times \$7 = ?

14. Fifteen chairs cost \$180. Find the cost of one of these chairs.

Statement. 15 times ? = \$180.

15. Find the cost of 8 tons of coal at \$14 a ton.

16. William sells Saturday Evening Posts at 5 cents each. His total sales for one week amounted to 95 cents. How many Posts did he sell?

17. Four Ford touring cars were sold for \$1640. What was the price of one car?

18. What is the weight of 2000 brick if each weighs 4 pounds?

19. Twenty-one school desks are bought for 168 dollars. Find the price of one of these desks.

20. What must be paid for ten typewriters at \$115 each?

Mental Tests

Directions. — Each pupil should have a small sheet of paper.

These should be of uniform size.

The pupil's name should be written at the top of the paper.

The numbers 1 to 10 should be written in the left margin.

The teacher will write on the blackboard: "Mental test, page , number ."

The teacher will announce the time the class may have to finish the test. This should not be more than five minutes.

Harry Horton
1
2
3
4
5
6
7
8
9
10

The pupil should be told to write only the answers.

Collect the papers and correct. Keep a record of the individual scores and also of the class. Those problems most frequently missed will indicate a proper line of review.

1

1. Divide 63 by 9.
2. Find $\frac{1}{4}$ of 16.
3. I spend 39¢. What change should I receive from a 50¢ piece?
4. 48 − 10 = ?
5. Mr. Jones buys potatoes at 80¢ a bushel and sells them for 95¢ a bushel. What does he gain on a bushel?

2

1. $\frac{1}{8}$ of 80 = ?
2. Add 15 and 10.
3. At $11 each how many coats can be bought for $99?
4. From 28 take 14.
5. What two numbers multiplied together will give 33?

3

1. $\frac{1}{2}$ of 16 = ?
2. How many inches in 2 feet?
3. John buys a cart for $8 and sells it for $5. How much does he lose?

4

1. $\frac{3}{4} + \frac{3}{4} = ?$
2. $\frac{3}{4} - \frac{1}{2} = ?$
3. Change $1\frac{3}{7}$ to 7ths.
4. Find L. C. M. 6, 10.
5. Find G. C. D. 6, 10.
6. $1 - \frac{5}{8} = ?$
7. Change $\frac{54}{9}$ to a mixed number.
8. $\frac{7 \times 8}{14} = ?$
9. $5 - ? = 4\frac{1}{4}$
10. Write 8,493 in words.

5

1. $\frac{11}{12} - \frac{3}{4} = ?$
2. $\frac{4}{5} + \frac{1}{2} = ?$
3. Change $\frac{33}{66}$ to lowest terms.
4. Change $\frac{32}{5}$ to a mixed number.
5. A book cost $\frac{1}{2}$ a dollar, a pad $\frac{1}{10}$ of a dollar, and a ball $\frac{1}{4}$ of a dollar. What did the three cost?
6. From a box containing $\$2\frac{3}{4}$ one and three fourths dollars are taken. How much remains?
7. What fraction added to $\frac{1}{2}$ equals $\frac{3}{4}$?
8. Add 20, 30, and 15.
9. $7 \times ? = 84.$
10. What are the prime factors of 72?

6

1. Find the cost of 20 pencils at $2¢$ each.
2. $147 \div 7 = ?$
3. $963 \div 3 = ?$
4. How many desks at $10 each can be bought for $400?
5. $\frac{1}{6}$ of 42 = ?
6. $\frac{1}{7}$ of 63 = ?
7. $\frac{3}{20} + \frac{7}{10} + \frac{1}{20} + \frac{3}{20} = ?$
8. $\frac{17}{20} - \frac{3}{10} = ?$
9. What are the prime factors of 64?
10. Add 50, 40, 20, and 18.

7

1. How many whips at $\$1\frac{1}{2}$ each can be bought for $3?
2. Find $\frac{5}{6}$ of 36.
3. Add $\frac{1}{12}$, $\frac{3}{4}$, $\frac{1}{3}$.
4. Subtract $\frac{5}{8}$ from $\frac{15}{16}$.
5. $\frac{22 \times 9}{33} = ?$
6. What part of 12 is 9?
7. Write 9,307,050 in words.
8. $\frac{7}{9} + ? = 1.$
9. $\frac{7}{8} - ? = \frac{3}{4}.$
10. What will 5 pairs of shoes cost at $4 a pair?

8

1. $\frac{1}{15} + \frac{3}{5} + 1 = ?$
2. $2\frac{4}{7} - 1\frac{3}{7} = ?$
3. What part of 45 is 9?
4. $\frac{18 \times 4}{12} = ?$
5. Change 2 to 10ths.
6. Reduce $\frac{27}{33}$ to lowest terms.
7. Change $\frac{33}{6}$ to a mixed number.
8. What must be added to $\frac{1}{3}$ to make $\frac{4}{5}$?
9. Add 15, 15, 30, 20 and 10.
10. Subtract $\frac{3}{4}$ from $\frac{4}{5}$.

Tests of Accomplishment

Directions. — These tests are arranged in order of difficulty. The *A* tests are for accuracy in processes and the *B* tests for the application of processes to a concrete situation. The pupils who can handle these tests satisfactorily will be found capable of proceeding to the next half year's work.

I — *A*

1. Add
   987
   899
   569
   805
   677
   945
   758
2. Subtract
   96372
   85383
3. Multiply 805 by 94.
4. Divide 198 by 9.
5. Find quotient
   $15762 \div 37$

I — *B*

1. Find the cost of 96 fruit trees at \$2 each.
2. How many chairs at \$14 each can be bought for \$434?
3. A carpenter's tool box with the tools cost \$138. If the tools cost \$119, what was the cost of the box?

4. A milkman disposed of 138 quarts of milk Sunday, 124 quarts Monday, 134 quarts Tuesday, 144 quarts Wednesday, 122 quarts Thursday, 128 quarts Friday, and 161 quarts Saturday. How many quarts did he sell during that week?

5. A city block costing $8940 is sold for $10,000. What was the gain?

II — *A*

1. Add 799
877
546
978
895
674
409

2. Subtract 83650
54685

3. Multiply 937 by 67.

4. Divide 553 by 7.

5. Find quotient
1774 ÷ 76

II — *B*

1. A dealer gained 35 dollars on the sale of a set of books costing him $95. What was the selling price of the books?

2. From a barrel containing 345 pounds of sugar 185 pounds are sold. How many pounds were left?

3. The pupils in the fifth grade sold 78 tickets for a school entertainment. They received 35 cents for each ticket. How much money was collected?

4. If one bus will carry 35 pupils, how many will be required to carry the 735 pupils in our school to the lake for an outing?

5. The men of a Rotary Club each contributed $15 to the Crippled Children's Fund. If they gave $1470, how many men are there in the club?

III — *A*

1. Change 7 to thirds.
2. Change $3\frac{3}{5}$ to an improper fraction.
3. Change $\frac{25}{4}$ to a mixed number.
4. Reduce $\frac{25}{30}$ to lowest terms.
5. Change $\frac{3}{5}$ to 20ths.
6. Add $13\frac{3}{5}$ / $3\frac{1}{2}$
7. Subtract 49 / $7\frac{4}{7}$
8. Subtract $15\frac{1}{3}$ / $9\frac{3}{4}$
9. Multiply 246 by $4\frac{2}{3}$.
10. Multiply $5\frac{5}{6}$ by $4\frac{2}{3}$.

III — *B*

1. A baseball costing $\frac{9}{10}$ of a dollar is sold for $1\frac{1}{4}$ dollars. What was the gain?
2. A wagon weighed $\frac{7}{8}$ ton and the load $1\frac{1}{4}$ tons. How much did both weigh?
3. If 12 eggs cost 40 cents, what will 15 eggs cost?
4. What must be added to $1\frac{4}{5}$ dollars to make $2\frac{1}{2}$ dollars?
5. A purchase amounted to $\$4\frac{1}{5}$. What change will be received from a five-dollar bill?

IV — *A*

1. Change 11 to eighths.
2. Change $4\frac{5}{6}$ to an improper fraction.
3. Change $\frac{37}{9}$ to a mixed number.
4. Reduce $\frac{36}{45}$ to lowest terms.
5. Change $\frac{3}{4}$ to twelfths.
6. Add $15\frac{1}{7}$ / $5\frac{2}{3}$
7. Subtract 37 / $6\frac{3}{5}$
8. Subtract $29\frac{3}{5}$ / $8\frac{3}{4}$
9. Multiply $24\frac{3}{4}$ by $3\frac{1}{3}$.
10. $642 \times 24\frac{5}{6} = ?$

IV — *B*

1. When 6 oranges can be bought for 35 cents, what will 30 oranges cost?

2. Milton ran $\frac{7}{8}$ of a mile to the school, $\frac{3}{4}$ of a mile on the school track, and $\frac{7}{8}$ of a mile returning to his home. How far did he run all together?

3. The cloth for a dress cost $\$3\frac{3}{5}$, the trimmings $\$1\frac{3}{4}$, the lining $\$1\frac{1}{2}$, and the cost of making $\$4\frac{2}{5}$. What was the total cost of the dress?

4. Which cost more and how much, the cloth and the lining or the trimmings and the making?

5. What must be added to $5\frac{7}{8}$ inches to make a foot?

V — *A*

1. Find the sum of $\frac{5}{8}$, $\frac{2}{3}$, and $\frac{3}{4}$.
2. Add $3\frac{7}{8}$, $4\frac{3}{4}$, and $2\frac{1}{2}$.
3. Subtract $4\frac{2}{3}$ from $7\frac{1}{7}$.
4. Multiply $12\frac{7}{8}$ by 4.
5. Find the product of $21\frac{7}{8}$ and $2\frac{2}{3}$.
6. What fraction must be added to $\frac{1}{6}$ to make $\frac{2}{5}$?
7. Reduce $\frac{24}{40}$ to lowest terms.
8. Change $11\frac{3}{8}$ to an improper fraction.
9. Reduce to whole or mixed numbers: $\frac{9}{4}$; $\frac{17}{8}$; $\frac{12}{4}$; $\frac{15}{2}$; $\frac{15}{3}$.
10. Divide 139528 by 214.

V — *B*

1. The snowfall for the month of February was $45\frac{1}{2}$ inches. The snowfall for one day was $28\frac{3}{4}$ inches. What was the snowfall for the remainder of the month?

2. To raise money for an outing the children of our fifth grade earned $\$2\frac{9}{10}$ selling pop corn, $\$5\frac{3}{5}$ selling the school colors, $\$21\frac{3}{4}$ from a movie benefit, and $\$45\frac{1}{2}$ from an ice cream social. How much did they earn all together?

3. How much more did they earn selling the school colors than by selling pop corn?

4. If two tires can be bought for \$45, what must be paid for 8 sold at the same rate?

5. What will 18 gallons of sirup cost at \$3 a gallon?

VI — *A*

1. $\frac{1}{7} + ? = \frac{5}{21}$
2. $\frac{7}{8} - \frac{5}{6} = ?$
3. $5\frac{4}{9} + 2\frac{1}{4} + 7\frac{5}{6} = ?$
4. $11\frac{5}{7} - 3\frac{4}{5} = ?$
5. $\frac{7}{8} \times \frac{2}{3} = ?$
6. $15\frac{3}{4} \times 2\frac{2}{3} = ?$
7. Give two factors of 6; 9 ; 10; 21, and 54.
8. What are the prime factors of 63?
9. Reduce $\frac{48}{63}$ to lowest terms.
10. Change $\frac{85}{7}$ to a mixed number.

VI — *B*

1. From a car containing $42\frac{2}{5}$ tons, $29\frac{9}{10}$ tons are sold. How many tons are left?

2. A tree measures $8\frac{1}{4}$ feet from the ground to the first limb. Philip can reach $6\frac{1}{12}$ feet. How high must he jump to grasp the first limb?

3. Four pieces of iron are bolted together. The first is $\frac{7}{8}$ of an inch thick, the second $1\frac{1}{16}''$, the third $1\frac{3}{4}''$, and the fourth $\frac{13}{16}''$. Find the thickness of the four taken together.

4. What must be paid for 14 city lots at $950 each?

5. United States produces an annual yield of 254,400,000 bushels of potatoes. The average number for each acre is 97 bushels. How many acres of land in the United States are used for potato producing?

FIFTH GRADE — SECOND HALF

Analysis

Read the problem carefully to know

(1) *What is given.*
(2) *What is to be found.*
(3) *The operation to be performed.*

1. Mr. Franklin earned $42 one week, $40 the next, and $46 the third. How much money did he earn in these three weeks?

The *number* of dollars earned is the *sum* of 42, 40, and 46, which is 128. Mr. Franklin earned $128.

2. Mr. Thomas bought an automobile for $2250 and sold it for $1600. How much money did Mr. Thomas lose?

The *number* of dollars lost is the *difference* between 2250 and 1600, which is 650. Mr. Thomas lost $650.

3. Eggs sell at 55 cents a dozen. Find the cost of 9 dozen eggs at the same rate.

The *number* of cents the eggs will cost is the *product* of 55 and 9, which is 495. The eggs cost 495 cents, or $4.95.

4. James saved $5 a week. In how many weeks can he save $75?

The *number* of weeks is the *quotient* of 75 divided by 5, which is 15. It will take 15 weeks.

Problems

1. Find the cost of 5 yards of cloth at \$2.34 a yard.

2. Floyd received \$17½ for 5 days' work. What did he receive a day?

3. What must be paid for 12 barrels of flour at \$10½ per barrel?

4. How many years was it from 1776 to 1861?

5. Raymond has saved \$15. How much more must he save to have enough to purchase a bicycle costing \$40?

6. What will 15 bushels of potatoes cost at \$1.25 a bushel?

7. Mr. Smith has a farm of 30 acres. What is it worth at \$175 an acre?

8. How many yards are there in 375 ft.?

9. How many feet are there in 69 inches?

10. How many oranges are there in 7½ dozen?

11. Milton's father buys 2¼ tons of corn, 1$\frac{3}{10}$ tons of bran, and 5⅘ tons of corn meal. How many tons does he buy in all?

12. Find the cost of 2½ dozen of eggs at 42 cents a dozen.

13. John had \$15. He spent \$7 for clothes and \$4 for shoes. How much had he left?

14. How many books at \$2 each can be bought for \$120?

15. Hay is bought at $\$16\frac{3}{4}$ a ton and sold for $\$20\frac{1}{2}$ a ton. Find the gain on one ton.

16. Find the cost of $8\frac{3}{4}$ pounds of butter at \$.60 a pound.

17. How many bushels of plums at \$3 a bushel can be bought for \$18?

18. How many pounds of butter at \$.45 a pound can be bought for \$4.05?

19. Four and one half rods equal how many feet?

20. Candy is put up in $\frac{1}{2}$-pound packages. How many packages can be made from 15 pounds?

21. Into how many city lots 60 feet wide can a piece of land having a frontage of 600 feet be divided?

22. Dexter cut an iron bar 35 ft. long into pieces that were 6 in. long. How many pieces were there?

23. What will $1\frac{1}{4}$ tons of grain cost at \$36 a ton?

24. How many cords of wood at \$4 a cord can be bought for \$28?

25. When a cow eats $6\frac{1}{4}$ pounds of grain a day, how many pounds are needed for 30 days?

26. When flour is \$3 a sack, how many sacks can be bought for \$360?

27. What will $1\frac{1}{2}$ bushels of peas cost at 30 cents a peck?

28. Frank makes 2 cents on each Sunday paper that he sells. How many papers must he sell to make 90 cents?

29. A bar of milk chocolate weighs $4\frac{1}{2}$ ounces. Find the weight of 12 bars.

30. Find the cost of $10\frac{1}{2}$ acres of land at \$24 an acre.

31. Mr. Fox buys 120 apple barrels at 80 cents each. How much money does he spend for barrels?

32. A city lot contains $\frac{1}{8}$ of an acre. Find the number of acres there are in 240 of these city lots.

33. Mr. Weeks draws $1\frac{1}{2}$ tons of grain at a load. How many tons will he draw in 10 loads?

34. Mr. Clark makes \$3.75 on each chair he sells. He sold 4 chairs in one day. What was his profit?

35. If it requires $\frac{1}{2}$ of a bushel of grass seed for an acre, how many quarts will it take for $\frac{1}{2}$ of an acre?

36. If it costs \$3 an hour to run an engine, how many hours can it be run for \$240 at the same rate?

37. Mr. DeLong's profit on sugar is $1\frac{3}{5}$ cents a pound. What is his profit on 100 pounds?

38. Change $6\frac{2}{3}$ feet to inches.

39. Find the cost of 12 yards of ribbon at $4\frac{1}{2}$ cents a yard.

40. What is the total gain when 500 tons of coal are sold at a gain of \$2.75 a ton?

41. Mr. Warren bought 180 apple trees. He sold $\frac{2}{3}$ of them at $\$\frac{3}{4}$ each. How much did he receive?

42. From a farm of $57\frac{7}{8}$ acres, $17\frac{1}{2}$ acres were sold. How many acres are left?

43. From a piece of cloth containing $37\frac{1}{6}$ yards, two pieces were cut, one of $6\frac{2}{3}$ yards and the other of $16\frac{3}{4}$ yards. How many yards remained?

44. Three fifths of a field of $6\frac{1}{4}$ acres is orchard. Find the number of acres of orchard.

45. Fur coats costing $\$87\frac{1}{2}$ were sold at a fire sale at a loss of $\$7\frac{1}{4}$. For what did each sell?

Division of Fractions

Dividing a Fraction by an Integer

Divide $\frac{6}{7}$ by 3.

6 sevenths $\div$ 3 = 2 sevenths.

Prin. 2. Dividing the numerator divides the fraction.

Oral. Give quotients:

1. $\frac{4}{5} \div 2 = ?$ **5.** $\frac{12}{17} \div 3 = ?$ **9.** $\frac{8}{9} \div 2 = ?$

2. $\frac{6}{11} \div 3 = ?$ **6.** $\frac{15}{16} \div 5 = ?$ **10.** $\frac{4}{9} \div 2 = ?$

3. $\frac{9}{10} \div 3 = ?$ **7.** $\frac{4}{15} \div 2 = ?$ **11.** $\frac{20}{21} \div 5 = ?$

4. $\frac{8}{13} \div 4 = ?$ **8.** $\frac{6}{11} \div 2 = ?$ **12.** $\frac{21}{3} \div 7 = ?$

$\frac{9}{10} \div 3 = ?$

$\frac{1}{\cancel{3}}$ of $\frac{\overset{3}{\cancel{9}}}{10} = \frac{3}{10}$. $\frac{\overset{3}{\cancel{9}}}{10} \times \frac{1}{\underset{1}{\cancel{3}}} = \frac{3}{10}$.

Dividing $\frac{9}{10}$ by 3 is the same as multiplying it by $\frac{1}{3}$. Multiplying the denominator divides the fraction.

Written

13. $\frac{7}{8} \div 4 = ?$ **16.** $\frac{15}{16} \div 3 = ?$ **19.** $\frac{8}{9} \div 16 = ?$

14. $\frac{9}{11} \div 3 = ?$ **17.** $\frac{8}{9} \div 5 = ?$ **20.** $\frac{12}{17} \div 4 = ?$

15. $\frac{5}{8} \div 2 = ?$ **18.** $\frac{18}{20} \div 6 = ?$ **21.** $\frac{4}{5} \div 6 = ?$

22. Five boys and a man receive pay for work. The man receives $\frac{1}{4}$ of the money, and the remaining $\frac{3}{4}$ is divided equally among the 5 boys. What part does each boy receive?

Dividing a Fraction by a Fraction

Divide $\frac{35}{72}$ by $\frac{5}{8}$. SOLUTION: $\frac{35 \div 5}{72 \div 8} = \frac{7}{9}$.

Since the terms of the dividend $\frac{35}{72}$ exactly contain the terms of the divisor $\frac{5}{8}$, we may take the quotient of the numerators for a new numerator, and the quotient of the denominators for a new denominator.

Divide $\frac{12}{25}$ by $\frac{3}{5}$.

Instead of dividing the terms thus: $\frac{12 \div 3}{25 \div 5}$, we may interchange the terms of the divisor and multiply, thus:

$$\frac{\cancel{12}^{4}}{\cancel{25}_{5}} \times \frac{\cancel{5}^{1}}{\cancel{3}_{1}} = \frac{4}{5}$$

This method is more convenient, especially when the terms of the dividend do not exactly contain those of the divisor. It permits us to employ cancellation.

To divide by a fraction interchange the terms of the divisor and multiply.

Find the quotients and express them in simplest form:

1. $\frac{4}{9} \div \frac{2}{3} = ?$
2. $\frac{8}{15} \div \frac{4}{5} = ?$
3. $\frac{12}{25} \div \frac{4}{5} = ?$
4. $\frac{25}{36} \div \frac{5}{6} = ?$
5. $\frac{24}{35} \div \frac{3}{7} = ?$
6. $\frac{9}{16} \div \frac{3}{4} = ?$
7. $\frac{32}{45} \div \frac{8}{9} = ?$
8. $\frac{21}{40} \div \frac{7}{10} = ?$
9. $\frac{16}{35} \div \frac{4}{5} = ?$
10. $\frac{15}{28} \div \frac{5}{7} = ?$
11. $\frac{14}{27} \div \frac{7}{9} = ?$
12. $\frac{18}{35} \div \frac{6}{7} = ?$
13. $\frac{25}{49} \div \frac{5}{7} = ?$
14. $\frac{24}{25} \div \frac{3}{5} = ?$
15. $\frac{21}{22} \div \frac{7}{11} = ?$
16. $\frac{15}{27} \div \frac{5}{9} = ?$
17. $\frac{9}{20} \div \frac{3}{10} = ?$
18. $\frac{15}{16} \div \frac{5}{8} = ?$
19. $\frac{14}{15} \div \frac{2}{5} = ?$
20. $\frac{16}{25} \div \frac{4}{5} = ?$
21. $\frac{21}{25} \div \frac{3}{5} = ?$
22. $\frac{49}{50} \div \frac{7}{10} = ?$
23. $\frac{36}{81} \div \frac{4}{9} = ?$
24. $\frac{15}{24} \div \frac{5}{8} = ?$

Find the quotient. Express in simplest form:

1.	$\frac{4}{5} \div \frac{2}{3} = ?$	**8.**	$\frac{2}{3} \div \frac{4}{5} = ?$	**15.**	$\frac{2}{3} \div \frac{4}{15} = ?$
2.	$\frac{7}{8} \div \frac{3}{4} = ?$	**9.**	$\frac{5}{6} \div \frac{5}{9} = ?$	**16.**	$\frac{5}{9} \div \frac{2}{3} = ?$
3.	$\frac{11}{12} \div \frac{5}{6} = ?$	**10.**	$\frac{5}{9} \div \frac{5}{6} = ?$	**17.**	$\frac{15}{16} \div \frac{5}{8} = ?$
4.	$\frac{8}{9} \div \frac{3}{4} = ?$	**11.**	$\frac{5}{6} \div \frac{3}{4} = ?$	**18.**	$\frac{3}{8} \div \frac{5}{16} = ?$
5.	$\frac{3}{5} \div \frac{5}{7} = ?$	**12.**	$\frac{3}{4} \div \frac{5}{6} = ?$	**19.**	$\frac{2}{3} \div \frac{8}{9} = ?$
6.	$\frac{5}{8} \div \frac{2}{3} = ?$	**13.**	$\frac{2}{5} \div \frac{6}{7} = ?$	**20.**	$\frac{8}{9} \div \frac{2}{3} = ?$
7.	$\frac{2}{5} \div \frac{2}{3} = ?$	**14.**	$\frac{3}{4} \div \frac{3}{16} = ?$	**21.**	$\frac{4}{9} \div \frac{2}{3} = ?$

Dividing an Integer by a Fraction

Divide 6 by $\frac{1}{3}$.

Express the integer as a fraction with 1 for a denominator.

Statement $\frac{6}{1} \div \frac{1}{3} = ?$ Proceed as in dividing a fraction by a fraction.

$6 \div \frac{2}{3} = ?$

STATEMENT: $\frac{6}{1} \div \frac{2}{3} = ?$ SOLUTION: $\frac{\overset{3}{\cancel{6}}}{1} \times \frac{3}{\underset{1}{\cancel{2}}} = 9.$

NOTE. — When a number is divided by a **proper fraction** the *quotient* is *greater* than the *dividend.*

Divide:

22.	9 by $\frac{3}{8}$	**25.**	12 by $\frac{3}{5}$	**28.**	16 by $\frac{4}{5}$	**31.**	5 by $\frac{2}{3}$
23.	16 by $\frac{8}{9}$	**26.**	27 by $\frac{7}{18}$	**29.**	25 by $\frac{5}{7}$	**32.**	7 by $\frac{2}{3}$
24.	7 by $\frac{5}{12}$	**27.**	35 by $\frac{7}{10}$	**30.**	18 by $\frac{6}{7}$	**33.**	22 by $\frac{4}{9}$

34. At $\$\frac{2}{5}$ a pound, how many pounds of butter will \$12 buy?

Division of Mixed Numbers

Mixed numbers may be reduced to *improper fractions.* Integers may be expressed as fractions with 1 for a denominator. Proceed as in dividing a *fraction* by a *fraction.*

Divide $4\frac{2}{3}$ by $5\frac{3}{5}$.

Solution. — $4\frac{2}{3} \div 5\frac{3}{5} = \frac{14}{3} \div \frac{28}{5}$; $\frac{\overset{1}{\cancel{14}}}{3} \times \frac{5}{\underset{2}{\cancel{28}}} = \frac{5}{6}$.

Divide 47 by $6\frac{1}{2}$.

Solution. — $47 \div 6\frac{1}{2} = \frac{47}{1} \div \frac{13}{2}$; $\frac{47}{1} \times \frac{2}{13} = \frac{94}{13}$ or $7\frac{3}{13}$.

Divide $4\frac{1}{2}$ by 3.

Solution. — $4\frac{1}{2} \div 3 = \frac{9}{2} \div 3$; $\frac{\overset{3}{\cancel{9}}}{2} \times \frac{1}{\cancel{3}} = \frac{3}{2}$ or $1\frac{1}{2}$.

Divide:

1.	$2\frac{1}{2}$ by $\frac{5}{8}$	**7.**	$3\frac{1}{2} \div \frac{14}{15}$	**13.**	$8 \div \frac{7}{10}$	**19.**	$2\frac{3}{4} \div \frac{11}{12}$
2.	$3\frac{1}{4}$ by $1\frac{1}{4}$	**8.**	$5\frac{1}{4} \div \frac{9}{20}$	**14.**	$10 \div \frac{5}{6}$	**20.**	$2\frac{1}{3} \div 3\frac{1}{2}$
3.	$8\frac{1}{3}$ by $\frac{5}{6}$	**9.**	$\frac{3}{11} \div 5\frac{3}{4}$	**15.**	$\frac{7}{8} \div 14$	**21.**	$8\frac{1}{9} \div 9\frac{1}{7}$
4.	15 by $3\frac{1}{3}$	**10.**	$\frac{7}{10} \div 4\frac{1}{5}$	**16.**	$\frac{16}{21} \div 8$	**22.**	$\frac{49}{54} \div \frac{14}{27}$
5.	$1\frac{5}{8}$ by $4\frac{4}{5}$	**11.**	$\frac{13}{15} \div 5\frac{1}{2}$	**17.**	$2\frac{3}{4} \div 5\frac{1}{2}$	**23.**	$\frac{42}{55} \div \frac{7}{11}$
6.	$3\frac{1}{2}$ by $2\frac{1}{3}$	**12.**	$2 \div \frac{4}{5}$	**18.**	$7\frac{1}{8} \div 1\frac{1}{2}$	**24.**	$10\frac{2}{9} \div 4\frac{10}{27}$

25. If $4\frac{1}{2}$ lb. of soda is put up in 18 packages, what part of a pound will each package contain?

26. Five girls shared $1\frac{1}{2}$ pounds of candy equally. What part of a pound did each have?

27. Mr. Carter feeds $2\frac{5}{8}$ bu. of grain to 14 cows. What part of a bushel is fed to each cow?

28. The product of two numbers is $16\frac{1}{3}$. One of them is 7. What is the other?

Problems

1. When 15 yards of silk cost $\$16\frac{7}{8}$, what is the price per yard?

2. Divide $75\frac{3}{5}$ by $15\frac{3}{5}$.

3. In one month Mr. Finlay earned $\$46\frac{3}{4}$, his wages being $\$2\frac{3}{4}$ a day. How many days did he work?

4. How much corn at $\$1\frac{1}{4}$ a bushel will \$75 buy?

5. If $\frac{7}{8}$ of a mile of telephone wire was divided into 14 equal pieces, how long was each piece?

6. By what must $2\frac{1}{8}$ be multiplied to obtain $2\frac{3}{7}$?

7. By what must $3\frac{8}{9}$ be divided to obtain $1\frac{4}{11}$?

8. How many aprons can be made from $10\frac{1}{2}$ yards of cloth, if $1\frac{3}{4}$ yards are needed for one apron?

9. Divide $85\frac{1}{7}$ by $14\frac{2}{3}$.

10. By what must 6 be multiplied to obtain 18?

11. By what must $\frac{5}{6}$ be multiplied to obtain $\frac{5}{7}$?

12. What is $\frac{1}{19}$ of 38?

13. One factor of $\frac{7}{16}$ is $\frac{5}{8}$. What is the other factor?

14. How many pieces $\frac{7}{8}$ of an inch long can be cut from a wire that is $10\frac{1}{2}$ inches long?

15. What will 8 tons of coal cost at $\$13\frac{3}{4}$ a ton?

16. A room 36 feet long is $\frac{1}{3}$ as wide as it is long. How wide is it?

17. If $\frac{1}{2}$ of John's money is \$10, how much money has he?

18. How many inches in $\frac{5}{12}$ of a foot?

19. What must be paid for $\frac{3}{4}$ of a ton of hay at \$20 a ton?

20. Seven eighths of a bushel is how many quarts?

DECIMAL FRACTIONS

3 tenths is written $\frac{3}{10}$ or .3
3 hundredths is written $\frac{3}{100}$ or .03
3 thousandths is written $\frac{3}{1000}$ or .003
These are **decimal fractions.**

Read:

1. .5 .8 .9 .7 .4.
2. .05 .08 .09 .07 .04.
3. .005 .008 .009 .007 .004.

The product of *equal* factors is a **power.**
$10 \times 10 = 100.$
$10 \times 10 \times 10 = 1000.$
100 and 1000 are powers of 10.
Therefore a fraction whose *denominator* is 10 or a **power** of ten is a **decimal fraction.**

3 hundredths is a *decimal fraction* because its denominator (100) is a *power* of 10.

When 3 hundredths is written $\frac{3}{100}$ it is said to be *in the form* of a *fraction.*

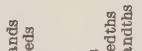
When 3 hundredths is written .03 it is called a *decimal.* The period is called the *decimal point.*

Express as fractions:

4. .3, .7, .9, .4, .04, .03, .05, .08.
5. .12, .15, .25, .42, .28, .13, .72.
6. .125, .321, .862, .003, .021, .182.

Reading and Writing Decimals

The places at the right of the decimal point are called **decimal places.**



.7 is read *7 tenths.*

.75 is read *75 hundredths.*

.754 is read *754 thousandths.*

1. Read: .8; .49; .786; .492.

2. Read: 500; 50; 5; .5; .05; .005.

3. Read: .25; .36; .39; .47; .365; .3; .7; .403; .07; .009.

4. How many cents make one dollar? What part of a dollar is one cent? 7 cents? 19 cents? 41 cents? 97 cents?

5. We write 25 cents, $.25 because it is 25 hundredths of a dollar.

6. 4321.648 is read 4321 *and* 648 *thousandths.*

Notice that *and* is used between the integer and the decimal. A number that is composed of an *integer* and a *decimal* is called a *mixed decimal.*

7. Read: 6.42; 17.5; 4.23; 583.97; .640; 7.640; 439.018; 9341.215; 68.43; 70.9; 893.047; 903.03; 642.008.

8. Read: 3.4; .003; .987; 2048.017; .001; 2000.02.

9. Read: 1.1; 1.5; 1.9; 1.95; 1.995.

Notice that the part of the number at the right of the decimal point is *always* less than 1.

10. What part of 10 units is 1 unit?

11. What part of 1 ten is 1 unit?

12. What part of 2 hundreds is 2 tens?

13. In the number 555, what is the value of the first 5 at the right? The second 5? The third 5?

14. Upon what does the value of any figure depend?

15. In the number 555, the value of the first 5 is what part of the value of the second 5?

16. Two tenths is what part of 2 units?

17. In the number 5.5, the value of the right-hand 5 is what part of the value of the left-hand 5?

18. In the decimal .555, what is the value of the first 5 at the right? The second 5? The third 5?

19. Name the denominator of .6; .17; .105; .006; .05; .225; .347; .06; .049; .207; .300.

20. Read the decimals in exercise **19.**

21. *Read:*

.368	37.005	$.42\frac{1}{2}$
.394	2520.36	$.69\frac{1}{6}$
.532	38000.006	$.8\frac{1}{3}$
.205	4983.69	.637

Write the following as decimals:

22. Two hundred eighty-two thousandths.

23. Fifty-six hundredths.

24. Seven tenths.

25. 500 thousandths.

26. Three hundred twenty-five thousandths.

Write decimally:

27. Eight tenths.
28. 29 hundredths.
29. Six and 284 thousandths.
30. 458 thousandths.
31. Twenty-five hundredths.
32. Twenty-five thousandths.
33. Thirty-eight hundredths.
34. Fifty-three thousandths.
35. 820 thousandths.
36. 1650 and 464 thousandths.
37. One thousand one, and 36 thousandths.
38. Sixteen, and six thousandths.
39. Seven hundred eight thousandths.
40. Twelve hundredths.
41. Seventy-five thousandths.
42. Seven hundred five thousandths.
43. Seven hundred, and five thousandths.
44. Four hundred three thousandths.
45. Four thousand, and three hundredths.
46. Twenty-four, and five thousandths.
47. Seventy-one, and seven thousandths.
48. Four hundred thirty-five, and four thousandths.
49. 800 thousandths.
50. Ninety-nine, and eighty-six thousandths.
51. Seventy-eight, and 200 thousandths.
52. Nine thousand seven, and nine hundredths.
53. One and one hundredth.

Reduction

1. Change to decimal form:
$\frac{25}{100} = .25$
2. Change to a common fraction:
$.36 = \frac{36}{100} = \frac{9}{25}$
3. $5.2 = 5\frac{2}{10} = \frac{52}{10}$

Change to decimals:

1. $\frac{25}{100}$	**6.** $\frac{384}{1000}$	**11.** $\frac{25}{1000}$	**16.** $\frac{9}{10}$
2. $\frac{85}{100}$	**7.** $\frac{49}{100}$	**12.** $\frac{11}{100}$	**17.** $\frac{1}{10}$
3. $\frac{326}{1000}$	**8.** $\frac{5}{10}$	**13.** $\frac{9}{100}$	**18.** $5\frac{40}{100}$
4. $\frac{6}{10}$	**9.** $\frac{6}{100}$	**14.** $\frac{500}{1000}$	**19.** $8\frac{2}{10}$
5. $\frac{16}{100}$	**10.** $\frac{15}{1000}$	**15.** $\frac{50}{100}$	**20.** $64\frac{683}{1000}$

Change to fractions and read:

21. .36	**26.** .485	**31.** 5.6
22. .7	**27.** .016	**32.** 5.06
23. .125	**28.** .16	**33.** 5.006
24. 12.2	**29.** .06	**34.** 5.600
25. 6.25	**30.** .6	**35.** 5.060

Write, first as fractions, or mixed numbers, then as decimals:

36. Four tenths.
37. Seventy-five hundredths.
38. One hundred twenty-five thousandths.
39. Sixteen, and forty-eight hundredths.
40. Six tenths.
41. Six hundredths.
42. Six thousandths.

$$.072 = \frac{72}{1000} = \frac{9}{125}$$
$$18.25 = 18\frac{25}{100} = 18\frac{1}{4}$$

Reduce to fractions or mixed numbers in simplest form:

1. .8	**8.** .125	**15.** 16.75
2. .25	**9.** .875	**16.** .001
3. .35	**10.** .375	**17.** .054
4. .75	**11.** .455	**18.** .025
5. .64	**12.** .025	**19.** .013
6. .52	**13.** .561	**20.** 5.25
7. .38	**14.** .368	**21.** $.34\frac{2}{7}$

SOLUTION: $.34\frac{2}{7} = 34\frac{2}{7} \div 100$; $\frac{\cancel{240}^{12}}{7} \times \frac{1}{\cancel{100}_{5}} = \frac{12}{35}$. *Ans.*

22. $.12\frac{1}{2}$	**32.** $2.33\frac{1}{3}$	**42.** $.16\frac{2}{3}$
23. $.62\frac{1}{2}$	**33.** $.3\frac{1}{7}$	**43.** $.19\frac{4}{7}$
24. $.06\frac{1}{4}$	**34.** $42.62\frac{1}{2}$	**44.** $.562\frac{1}{2}$
25. $.18\frac{1}{8}$	**35.** .97	**45.** $.40\frac{5}{7}$
26. $.03\frac{3}{4}$	**36.** .56	**46.** $.41\frac{1}{9}$
27. $.25\frac{4}{5}$	**37.** $.06\frac{1}{4}$	**47.** $.1\frac{5}{6}$
28. $.87\frac{1}{2}$	**38.** .40	**48.** .79
29. $.66\frac{2}{3}$	**39.** .07	**49.** .30
30. $.36\frac{7}{8}$	**40.** $.26\frac{2}{3}$	**50.** .28
31. 16.25	**41.** $.012\frac{6}{7}$	**51.** .98

Change $\frac{3}{8}$ to a decimal.

$$8\overline{)3.000} \qquad .375$$

$\frac{3}{8} = 3 \div 8 = .375.$

1. $\frac{1}{2} = .5$ **2.** $\frac{1}{4} = .25$ **3.** $\frac{1}{8} = .125$ **4.** $\frac{1}{16} = .0625$

Reduce to decimals:

5. $\frac{4}{5}$	**10.** $\frac{7}{8}$	**15.** $\frac{1}{40}$	**20.** $\frac{3}{20}$
6. $\frac{3}{4}$	**11.** $\frac{19}{25}$	**16.** $\frac{3}{60}$	**21.** $\frac{1}{10}$
7. $\frac{4}{25}$	**12.** $\frac{1}{625}$	**17.** $\frac{3}{8}$	**22.** $\frac{1}{5}$
8. $\frac{12}{40}$	**13.** $\frac{7}{125}$	**18.** $\frac{3}{50}$	**23.** $\frac{5}{80}$
9. $\frac{9}{16}$	**14.** $\frac{6}{25}$	**19.** $\frac{4}{25}$	**24.** $\frac{1}{60}$

$.2\frac{1}{2} = .2 + (\frac{1}{2}$ of $\frac{1}{10}$, or $\frac{1}{20}$ or $.05)$

$.2 + .05 = .25$

In a similar manner, we may show that

$.27\frac{1}{2} = .275$; $.38\frac{4}{5} = .388.$

Also, that $.2\frac{1}{4} = .225$ $.34\frac{2}{5} = .344$

$.8\frac{3}{4} = .875$ $.06\frac{1}{2} = .065$

$.9\frac{1}{5} = .92$ $.07\frac{3}{5} = .076$

Express as entire decimals:

25. $.2\frac{1}{2}$	**28.** $.17\frac{1}{2}$	**31.** $.36\frac{1}{2}$	**34.** $7\frac{1}{4}$	**37.** $.04\frac{2}{5}$
26. $.8\frac{1}{4}$	**29.** $3.7\frac{1}{4}$	**32.** $9.2\frac{1}{4}$	**35.** $.39\frac{1}{2}$	**38.** $.14\frac{5}{10}$
27. $.05\frac{1}{5}$	**30.** $1.1\frac{3}{4}$	**33.** $21.4\frac{3}{4}$	**36.** $.33\frac{1}{5}$	**39.** $.09\frac{1}{2}$

Addition and Subtraction of Decimals

Decimals are added and subtracted in the same manner as integers. The numbers are written so that the decimal points are in a column.

4.375	391.42
.35	165.703
28.306	225.717 *Difference*
351.294	
384.325 *Sum*	

Add:

1.	2.	3.	4.
2.2	3.25	4.5	.004
34.5	7.163	.168	4.1
79.89	15.003	2.12	16.156

5. .175 + 1.75 + 17.5 + 175
6. 145 + 14.5 + 1.45 + .145 + .014
7. 3.2 + 14.006 + .006 + 25.384 + .1
8. .8 + .446 + 59.3 + 2.575 + 1.005 + .3
9. 1.45 + 2.365 + 96 + .96 + 15.863 + 4.3 + .004
10. 446 + 44.6 + 375 + 9 + .8 + .321 + .16
11. 21.005 + .384 + .1 + .005 + 3.6 + .158
12. 1.006 + 2001.1 + .003 + 5.5 + 11.111
13. 205.07 + 301.2 + 687.912 + 83.045 + 200
14. .308 + 308 + 8.09 + 9.078 + 859
15. 2378 + 23.50 + .890 + .089 + 1.088

1. *Subtract:*

a.	*b.*	*c.*	*d.*
24.3	2.86	4.	2.46
4.5	1.325	1.15	.005

2. $7 - .15$
3. $1 - .004$
4. $13 - 2.1$
5. $3.256 - 1.05$
6. $256.1 - 1.256$
7. $29.325 - 15.14$
8. $3.852 - .125$
9. $1.111 - .001$
10. $500 - .05$
11. $25.389 - 15.005$

12. From twenty-eight, and twenty-five thousandths take fourteen, and twenty-five hundredths.

13. From one tenth take one thousandth.

14. (*a*) Which is the greater, fifty thousandths or five hundredths? (*b*) Three tenths or three thousandths?

15. Take one thousandth from one thousand.

16. From five hundred take five hundredths.

Find results:

17. $175 - 30.23$
18. $.015 + 1.05 + .57 + 5.7 + 1.04 + .004 + 75.36$
19. $50.4 - .504$
20. $25.006 + 200.08 + 6.005 + 49.005 + 300.059$
21. $2.005 + 5.5 + 25.010 + 3.204$

22. Find the sum of two hundred forty, and four hundred fifty thousandths; thirty-four, and three hundredths; six hundred four, and six hundred four thousandths.

Subtract:

1. 32.854	3. 86.2	5. 21.101
9.378	43.948	7.999
2. 19.042	4. 36.015	6. 28.78
16.854	24.008	21.987

7. There are four villages on the same road. From the first to the second is 8.46 miles; from the second to the third, 10.5 miles; from the first to the fourth, 25 miles. Make a drawing representing the road and find the distance from the third village to the fourth.

Multiplying and Dividing by Multiples of Ten

Oral

1. How may decimals be multiplied by 10? By 100? By 1000?

2. *Multiply by* 10: by 100: by 1000:
5.25; .06; 3.7; 593.207; 6.800; 9.16; 82; 420; .035; .006.

3. *Multiply by* 100: by 1000:
62.843; 3.215; 75.16; 3.18; .65; 2.3; 5; 520.

4. By what must .503 be multiplied to obtain 5.03? 503.? 50.3?

5. Moving the decimal point one place to the left is the same as moving all the figures of the number one place to the right. For example, by moving the decimal point one place to the left in the number 42.3, it becomes 4.23. How does this affect the value of the number?

6. What is the easiest way to divide by 10?

7. *Divide by* 10: by 100:

35.; 247.; 385.; 16.; 24.3; 2.59; 347.69; 8.137; 42.69; 394.68; .72; .04.

8. How may we divide decimals by 100?

9. *Divide by* 100:

3567.8; 937.; 635.; 42304.; 687.9; 485.

10. By what must 8193 be divided to obtain 819.3? 8.193? 81.93?

11. How must the decimal point be moved to change tenths to hundredths? Thousandths to tenths?

12. *Divide as follows:*

64.2 by 10; 83.75 by 10; 63.5 by 100; 4251 by 1000; 33 by 1000; 5 by 100.

13. What is the effect of moving the decimal point three places to the left? One place? Two places?

14. *Find results:*

3.5×10; $6.5 \div 10$; $83 \div 1000$; $987 \div 1000$; $.843 \times 100$.

15. What is the effect of moving the decimal point to the left one place? To the right two places? To the left three places? To the right three places?

16. How may we multiply a decimal by 1000? How may we divide a decimal by 1000?

Multiplication of Decimals

Multiply 6.41 by 3.2.

$$\begin{array}{r} 6.41 \\ 3.2 \\ \hline 1282 \\ 1923 \\ \hline 20.512 \end{array}$$

$6.41 = \frac{641}{100}$. $3.2 = \frac{32}{10}$.

$\frac{641}{100} \times \frac{32}{10} = \frac{20512}{1000}$.

$\frac{20512}{1000} = 20\frac{512}{1000}$.

$20\frac{512}{1000} = 20.512$.

NOTE. — Observe that 6.41 is *less* than 7, and that 3.2 is *less* than 4. The product therefore is *less* than 4×7, or 28. It is *more* than 3×6, or 18.

Point off in the product as many decimal places as there are decimal places in both factors.

Multiply:

1. $.7 \times .08$
2. $.3 \times .5$
3. $.4 \times .27$
4. $.2 \times .18$
5. $.21 \times .3$
6. $.7 \times .05$
7. $.06 \times .5$
8. $.14 \times .4$
9. $.3 \times .7$
10. $.12 \times .8$
11. $.6 \times .11$
12. $.9 \times .15$
13. $.2 \times .61$
14. $.4 \times .18$
15. $.5 \times .13$
16. $.12 \times .6$
17. $.15 \times .6$
18. $.14 \times .5$
19. $2.8 \times 3.2 = ?$ The product is about 9. Why?

20. $2.5 \times 10.6 = ?$
21. $5.6 \times 3.1 = ?$
22. $13.3 \times 1.3 = ?$
23. $2.84 \times 2.5 = ?$
24. $3.25 \times 13.6 = ?$
25. $27.4 \times 1.14 = ?$
26. $19.2 \times 4.13 = ?$
27. $23.8 \times 1.82 = ?$
28. $30.2 \times 5.5 = ?$
29. $1.38 \times 2.4 = ?$

Estimate the products:

1. $.3 \times .4 = ?$
2. $.05 \times .4 = ?$
3. $.7 \times .9 = ?$
4. $.7 \times .11 = ?$
5. $.8 \times .09 = ?$
6. $.4 \times .13 = ?$
7. $.24 \times .3 = ?$
8. $.08 \times .3 = ?$
9. $.15 \times .4 = ?$
10. $.19 \times .3 = ?$
11. $.7 \times .6 = ?$
12. $.2 \times .18 = ?$
13. $.3 \times .17 = ?$
14. $.9 \times .5 = ?$
15. $.6 \times .12 = ?$
16. $.4 \times .17 = ?$
17. $.3 \times .22 = ?$
18. $.15 \times .7 = ?$
19. $.18 \times .3 = ?$
20. $.21 \times .4 = ?$
21. $3.4 \times .2 = ?$
22. $6.1 \times .3 = ?$
23. $2.3 \times .05 = ?$
24. $.7 \times 1.1 = ?$
25. $.9 \times .3 = ?$
26. $.11 \times .5 = ?$
27. $.5 \times 2.2 = ?$
28. $.3 \times 1.8 = ?$
29. $.6 \times 1.7 = ?$
30. $.4 \times .09 = ?$
31. $.12 \times .9 = ?$
32. $1.2 \times .7 = ?$
33. $.6 \times 1.5 = ?$
34. $.07 \times .9 = ?$
35. $6.3 \times .3 = ?$
36. $2.7 \times .02 = ?$
37. $1.3 \times .3 = ?$
38. $3.1 \times .02 = ?$
39. $6.4 \times .01 = ?$
40. $3.2 \times 3.6 = ?$
41. $86 \times .09 = ?$
42. $9.8 \times .05 = ?$
43. $.039 \times 57 = ?$
44. $6394 \times .029 = ?$
45. $864 \times .278 = ?$
46. $208.7 \times 30.9 = ?$
47. $930 \times 6.80 = ?$
48. $7.9 \times 1.02 = ?$
49. $43.55 \times .6 = ?$
50. $2354 \times .008 = ?$
51. $6.82 \times 867 = ?$
52. $2400 \times .387 = ?$
53. $920 \times 6.37 = ?$
54. $.992 \times 3001 = ?$
55. $2460 \times .039 = ?$
56. $1234 \times .56 = ?$
57. $9.924 \times 106 = ?$
58. $78.08 \times 3.1 = ?$
59. $721 \times .025 = ?$
60. $369 \times .125 = ?$
61. $248 \times .351 = ?$
62. $141 \times .026 = ?$
63. $97 \times .157 = ?$

Problems

1. Mr. Drainer buys 8276 feet of lumber. How much will it cost him at $45 a thousand feet?

2. Mr. Black sells bread for $8 for a hundred loaves. How much does he receive for 475 loaves?

3. Mr. Coleman sells potatoes for $1.50 a hundred pounds. How much does he receive for 675 pounds?

4. Mr. Conklin sells grain for $22.50 per thousand pounds. How much should he receive for 16,400 pounds?

5. Mr. Sears bought 855 yards of silk at $225 per hundred yards. How much did it cost?

6. Mr. Coon buys gasoline for $16.50 per hundred gallons. How much would 275 gallons cost him?

7. Mr. Allen buys sausage at $18 per hundred pounds. How much does he pay for 225 pounds?

8. A junk dealer buys old paper for 30 cents a hundred. How much must he pay for 2760 pounds of paper?

9. If George's father receives $1.10 a hundred pounds for pressed hay, how much will he receive for 12,500 pounds?

10. Mr. Caswell buys milk for $3.07 a hundred pounds. Find the value of 1275 pounds of milk at that rate.

11. Find the cost of 1425 pounds of sugar at $8.25 a hundred pounds.

Division of Decimals

1. Divide 7.47 by 3.

$$3\overline{)7.47} \quad 2.49$$

1. When the divisor is an integer, place the decimal point in the quotient directly above the decimal point in the dividend.
2. Divide as in whole numbers.

TEST: $3 \times 2.49 = 7.47$

Divisor × Quotient = Dividend

Estimate the quotient, divide and test:

2. $15.9 \div 3 = ?$
3. $25.75 \div 5 = ?$
4. $27.35 \div 5 = ?$
5. $4.824 \div 4 = ?$
6. $6.35 \div 5 = ?$
7. $10.367 \div 7 = ?$
8. $23.54 \div 11 = ?$
9. $73.458 \div 9 = ?$
10. $44.079 \div 7 = ?$
11. $72.144 \div 3 = ?$
12. $97.92 \div 12 = ?$
13. $13.008 \div 6 = ?$
14. $87.492 \div 12 = ?$
15. $17.437 \div 7 = ?$
16. $491.05 \div 5 = ?$
17. $24.876 \div 4 = ?$
18. $18.601 \div 11 = ?$
19. $4.428 \div 4 = ?$
20. $32.071 \div 13 = ?$
21. $133.98 \div 11 = ?$
22. $17.112 \div 12 = ?$
23. $145.53 \div 9 = ?$
24. $496.8 \div 8 = ?$
25. $29.748 \div 12 = ?$
26. $17.897 \div 11 = ?$
27. $85.26 \div 7 = ?$
28. $1.928 \div 8 = ?$
29. $8.135 \div 5 = ?$
30. $32.136 \div 12 = ?$
31. $73.65 \div 5 = ?$
32. $1.309 \div 7 = ?$
33. $37.284 \div 6 = ?$
34. $113.89 \div 7 = ?$
35. $16.443 \div 9 = ?$
36. $.724 \div 4 = ?$
37. $.889 \div 7 = ?$
38. $13.416 \div 8 = ?$
39. $1.998 \div 9 = ?$

1. Divide .156 by .04

$$.04\overline{).156} = 4\overline{)15.6}$$
$$3.9$$

1. When both the dividend and divisor are decimals, make the divisor an integer by multiplying it by 10 or a power of 10.

2. Move the decimal point in the dividend as many places to the right as there were decimal places in the divisor.

3. Place the decimal point in the quotient directly above the decimal point in the dividend and divide as in whole numbers.

TEST: $.04 \times 3.9 = .156$

Divisor × Quotient = Dividend

Find the quotient and test:

2. $1.708 \div .4 = ?$
3. $1.022 \div .07 = ?$
4. $1.368 \div .08 = ?$
5. $.252 \div .9 = ?$
6. $.847 \div .07 = ?$
7. $19.28 \div .8 = ?$
8. $2.583 \div .009 = ?$
9. $.815 \div .05 = ?$
10. $4.902 \div .3 = ?$
11. $8.394 \div .03 = ?$
12. $.508 \div .004 = ?$
13. $43.68 \div .06 = ?$
14. $10.835 \div .5 = ?$
15. $1.752 \div .7 = ?$
16. $2.272 \div .008 = ?$
17. $.385 \div .005 = ?$
18. $.261 \div .09 = ?$
19. $8.46 \div .6 = ?$

Divide and test:

20. $14.28 \div .07 = ?$
21. $.468 \div .004 = ?$
22. $1.272 \div .06 = ?$
23. $24.471 \div .9 = ?$
24. $.848 \div .008 = ?$
25. $2.075 \div .05 = ?$
26. $4.249 \div .7 = ?$
27. $80.73 \div .3 = ?$
28. $30.247 \div .007 = ?$
29. $129.36 \div .08 = ?$
30. $31.405 \div .005 = ?$
31. $10.008 \div .009 = ?$
32. $9.989 \div .7 = ?$
33. $13.038 \div .06 = ?$
34. $22.263 \div .003 = ?$
35. $49.284 \div .6 = ?$

1. Divide 7 by .04

$$.04\overline{)7.} = 4\overline{)700.}$$
$$175$$

1. When the dividend is an integer and the divisor a decimal, make the divisor a whole number by multiplying it by 10 or a power of 10.

2. Add to the dividend as many zeros as there were decimal places in the divisor.

3. Place the decimal point in the quotient directly above the decimal point in the dividend and divide as in whole numbers.

NOTE. — Observe that the decimal point in the dividend immediately follows the last zero added.

TEST: $.04 \times 175 = 7.$

Divisor × Quotient = Dividend

Find the quotient and test:

2. $8 \div .25 = ?$
3. $6 \div .15 = ?$
4. $10 \div 2.5 = ?$
5. $4 \div .04 = ?$
6. $9 \div .003 = ?$
7. $7 \div 2.5 = ?$
8. $3 \div .015 = ?$
9. $2 \div .004 = ?$
10. $8 \div .02 = ?$
11. $9 \div .006 = ?$
12. $6 \div 2.5 = ?$
13. $4 \div .08 = ?$
14. $6 \div .015 = ?$
15. $12 \div .04 = ?$
16. $8 \div .005 = ?$
17. $3 \div .06 = ?$
18. $1 \div .04 = ?$
19. $7 \div .007 = ?$
20. $15 \div .05 = ?$
21. $10 \div .002 = ?$
22. $16 \div .025 = ?$
23. $1 \div 2.5 = ?$
24. $6 \div .005 = ?$
25. $3 \div .012 = ?$
26. $9 \div .018 = ?$
27. $12 \div .005 = ?$
28. $2 \div .025 = ?$
29. $5 \div 2.5 = ?$

1. Divide 26.83 by 2.3

$$
\begin{array}{r}
11.665+ \\
23\overline{)268.300} \\
23 \\
\hline
38 \\
23 \\
\hline
153 \\
138 \\
\hline
150 \\
138 \\
\hline
120 \\
115 \\
\hline
5
\end{array}
$$

1. When the divisor is not contained in the dividend an exact number of times, annex ciphers to the dividend until there are three places of decimals in the quotient.

2. Place a plus (+) sign after the last figure in the quotient to show there is a remainder.

TEST: $2.3 \times 11.665 + 5 = 268.3$

Divisor × Quotient + Remainder = Dividend

Find the quotient and test:

2. $60.96 \div 1.6 = ?$
3. $.075 \div .05 = ?$
4. $91.56 \div 12 = ?$
5. $375 \div 12.5 = ?$
6. $16 \div 4.3 = ?$
7. $11.27 \div 4.9 = ?$
8. $23.322 \div .026 = ?$
9. $14.4 \div .018 = ?$
10. $125 \div 1.25 = ?$
11. $25.5 \div 3.4 = ?$
12. $12 \div 2.61 = ?$
13. $15.906 \div .6 = ?$
14. $36.192 \div 5.8 = ?$
15. $14.5 \div .2 = ?$
16. $1.68 \div 5 = ?$
17. $23.6 \div 1.8 = ?$
18. $36.48 \div .12 = ?$
19. $240 \div .04 = ?$
20. $21.7 \div 3.5 = ?$
21. $7.64 \div 6 = ?$
22. $24.3 \div .33 = ?$
23. $16.5 \div 15 = ?$
24. $247 \div .3 = ?$
25. $18.8 \div .08 = ?$
26. $2.44 \div 6 = ?$
27. $9.5 \div 1.25 = ?$
28. $1.47 \div 2.3 = ?$
29. $6 \div 1.45 = ?$
30. $2.18 \div 1.07 = ?$
31. $16.8 \div .042 = ?$

Aliquot Parts

One of the equal parts of a number is an **aliquot part** of that number.

$50¢$	=	$\frac{1}{2}$ of \$1.00
$33\frac{1}{3}¢$	=	$\frac{1}{3}$ of \$1.00
$25¢$	=	$\frac{1}{4}$ of \$1.00
$20¢$	=	$\frac{1}{5}$ of \$1.00
$16\frac{2}{3}¢$	=	$\frac{1}{6}$ of \$1.00
$12\frac{1}{2}¢$	=	$\frac{1}{8}$ of \$1.00
$10¢$	=	$\frac{1}{10}$ of \$1.00
$8\frac{1}{3}¢$	=	$\frac{1}{12}$ of \$1.00
$6\frac{1}{4}¢$	=	$\frac{1}{16}$ of \$1.00
$5¢$	=	$\frac{1}{20}$ of \$1.00

This Table contains the principal **aliquot parts** of \$1.00. These numbers and their corresponding fractions are often useful in the solution of problems.

Pupils should be taught that, —

as $\$.12\frac{1}{2}$ is $\frac{1}{8}$ of \$1.00
so $12\frac{1}{2}$ is $\frac{1}{8}$ of 100
and $.12\frac{1}{2}$ is $\frac{1}{8}$ of 1.

1. Memorize the aliquot parts in this table.

2. Cover the first column with a card and see if you can give all the aliquot parts.

3. Cover the second column with a card and see if you can give the corresponding fractions.

4. $\frac{1}{4}$ of \$1 = ? $\frac{1}{4}$ of 100 = ? $\frac{1}{4}$ of 1 = ?

5. $\frac{1}{6}$ of \$1 = ? $\frac{1}{6}$ of 100 = ? $\frac{1}{6}$ of 1 = ?

6. What will 12 tickets cost at $25¢$ each?

7. What will 12 cans of corn cost at $16\frac{2}{3}¢$ each?

8. At \$.50 a dozen how many dozen eggs can be bought for \$14?

9. At $8\frac{1}{3}¢$ each, how many grape fruit can be bought for $75¢$?

10. At $20¢$ a box, how many boxes of berries can be bought for \$2?

Problems

1. At 25¢ each, what will 8 handkerchiefs cost?

$8 \times \$.25 = 8 \times \$\frac{1}{4}$.

2. When cloth is 20¢ a yard, how many yards will \$15 buy? $\$15 \div \$\frac{1}{5} = ?$

Multiply:

3. $12\frac{1}{2}$ cents by 16
4. $16\frac{2}{3}$ cents by 12
5. 25 cents by 20
6. $33\frac{1}{3}$ cents by 27
7. $6\frac{1}{4}$ cents by 16
8. $8\frac{1}{3}$ cents by 24
9. $37\frac{1}{2}$ cents by 8
10. 50 cents by 15
11. $62\frac{1}{2}$ cents by 8
12. $66\frac{2}{3}$ cents by 9
13. 75 cents by 4
14. $87\frac{1}{2}$ cents by 8

What is the cost of:

15. 16 pounds of bacon at 25¢ a pound?
16. 16 balls at 50¢ each?
17. 36 yards of ribbon at $33\frac{1}{3}$¢ a yard?
18. 36 pounds of candy at 25¢ a pound?
19. 8 pounds of tea at 50¢ a pound?
20. At 50¢ each how many balls can be bought for \$3?
21. At $33\frac{1}{3}$¢ each how many yards of cloth can I buy for \$2?
22. At $12\frac{1}{2}$¢ a pound how much rice will \$3 buy?

Divide:

23. \$3 by $33\frac{1}{3}$¢
24. \$9 by $12\frac{1}{2}$¢
25. \$6 by $33\frac{1}{3}$¢
26. \$5 by 25¢
27. \$1 by $6\frac{1}{4}$¢
28. \$4 by $12\frac{1}{2}$¢
29. \$2 by $8\frac{1}{3}$¢
30. \$10 by 50¢
31. \$2 by 25¢

Useful Fractional Parts of $1.00

$30¢ = \frac{3}{10}$	of $1.00
$70¢ = \frac{7}{10}$	of $1.00
$90¢ = \frac{9}{10}$	of $1.00
$40¢ = \frac{2}{5}$	of $1.00
$60¢ = \frac{3}{5}$	of $1.00
$80¢ = \frac{4}{5}$	of $1.00
$37\frac{1}{2}¢ = \frac{3}{8}$	of $1.00
$62\frac{1}{2}¢ = \frac{5}{8}$	of $1.00
$87\frac{1}{2}¢ = \frac{7}{8}$	of $1.00
$66\frac{2}{3}¢ = \frac{2}{3}$	of $1.00
$75¢ = \frac{3}{4}$	of $1.00

1. Memorize these numbers and their corresponding fractions.

2. Cover first one column and then the other, and see if you can give the numbers covered.

$\frac{3}{8}$ of $1 = $.37\frac{1}{2}$
$\frac{3}{8}$ of 100 = $37\frac{1}{2}$
$\frac{3}{8}$ of 1 = $.37\frac{1}{2}$

Find the cost of:

3. 75 lb. tea @ 40¢.

4. 12 lb. coffee @ $37\frac{1}{2}¢$.

5. 16 neckties @ 75¢.

6. 25 pounds bacon @ 30¢.

7. What is the value of 728 sacks of potatoes at $87\frac{1}{2}¢$ a sack?

8. What must the school board pay for 960 gross of pens at $62\frac{1}{2}¢$ a gross?

9. What did Mr. Stone, the druggist, pay for 584 boxes of candy at an average price of $37\frac{1}{2}¢$ a box?

10. At 25¢ per box, how many boxes of candy could be bought for $89?

11. Fred saves 75¢ a week. In how many weeks will he save $60?

Problems

What is the cost of:

1. 166 pounds of pork at $33\frac{1}{3}$ cents a pound?
2. 348 pounds of veal at 20 cents a pound?
3. 265 boxes of strawberries at 25 cents a box?
4. 1215 yards of flannel at $66\frac{2}{3}$ cents a yard?
5. 3580 pounds of honey at 25 cents a pound?
6. 748 pounds of tea at 50 cents a pound?
7. At 25¢ per pound, how many pounds of cheese can be bought for $45?
8. $3 divided by $8\frac{1}{3}¢ = ?$
9. At 25 cents apiece, how many hats can be bought for $6?
10. At 25 cents a pound, how many pounds of roast can be bought for $5?
11. At $16\frac{2}{3}$ cents a can, how many cans of corn can be bought for $4?

Using aliquot parts, reduce the following to mixed numbers:

12. $58.50	15. $6.05	18. $15.08\frac{1}{3}$
13. $39.33\frac{1}{3}$	16. $32.12\frac{1}{2}$	19. $422.33\frac{1}{3}$
14. $5.16\frac{2}{3}$	17. $19.10	20. $100.14\frac{2}{7}$

At sight, reduce the following to common fractions or mixed numbers:

21. $.62\frac{1}{2}$	24. 12.875	27. $29.87\frac{1}{2}$	30. 43.4
22. $.66\frac{2}{3}$	25. 13.02	28. 3.6	31. $12.37\frac{1}{2}$
23. .75	26. 430.625	29. 7.8	32. 54.375

Problems

Solve, using cancellation:

1. $\frac{6 \times 15 \times 7}{5 \times 9}$
2. $\frac{14 \times 16 \times 5}{7 \times 20}$
3. $\frac{21 \times 20 \times 11}{7 \times 12}$
4. $\frac{22 \times 21 \times 10}{11 \times 6 \times 5}$
5. $\frac{26 \times 18 \times 15}{13 \times 12 \times 5}$
6. $\frac{33 \times 20 \times 28}{11 \times 15 \times 7}$
7. $\frac{44 \times 36 \times 19}{11 \times 16 \times 19}$
8. $\frac{19 \times 28 \times 15}{21 \times 38}$
9. $\frac{63 \times 36 \times 10}{27 \times 24}$
10. $\frac{77 \times 20 \times 13}{35 \times 44}$
11. $\frac{27 \times 24 \times 22}{36 \times 12}$
12. $\frac{20 \times 33 \times 75}{55 \times 50}$
13. $\frac{45 \times 16 \times 15}{30 \times 24}$
14. $\frac{34 \times 49 \times 27}{21 \times 18}$
15. $\frac{81 \times 35}{21 \times 45}$

16. If 6 watches cost \$40, what will 18 watches cost?

ANALYSIS. — *a.* 1 watch will cost $\$\frac{40}{6}$.
18 watches will cost $18 \times \frac{40}{6}$, or,
b. 18 watches will cost $\frac{18}{6} \times$ the cost of 6 watches.

STATEMENT. — $\frac{18 \times 40}{6} = ?$ SOLUTION. — $\frac{\overset{3}{\cancel{18}} \times \$40}{\underset{1}{\cancel{6}}} = \$120$ *Ans.*

Make statements and solve by cancellation:

17. If 4 bicycles cost \$140, what will 3 bicycles cost?

18. If a man earns \$24.50 in 7 days, what will he earn in 12 days?

19. If 8 rugs cost \$248, what will 11 rugs cost?

20. What must I pay for 8 opera tickets if 6 cost \$9.30?

21. If 7 tons of coal are used in making 5 tons of paper, how many tons of coal will be used in making 250 tons of paper?

12	= 1 dozen
12 dozen	= 1 gross

1. Name three articles that are sold by the dozen.

2. Name an article that is sold by the gross.

3. When eggs are worth 60 cents a dozen, how much will a crate holding 1 gross cost?

4. When the school board pays 60 cents a gross for pens, how much is paid per dozen?

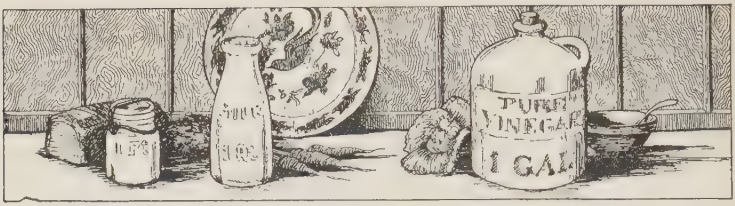
5. How much is received for a gross of coat hooks, when they are sold at 10 cents a dozen?

6. A merchant buys screws at 20 cents a gross and sells them at 5 cents a dozen. What is his profit on 2 gross?

7. How many tablets are there in a box containing ten gross?

8. What will be the profit on a gross of clothespins bought for 50¢ and sold at 12¢ a dozen?

9. At $3 a dozen what will a gross of tennis balls cost?



2 pints = 1 quart
4 quarts = 1 gallon

Change to pints:

1. 8 qt.	**4.** 1 gal. 2 qt.	**7.** 3 gal. 1 qt.
2. 3 qt. 1 pt.	**5.** 2 gal. 1 qt.	**8.** 6 gal. 2 qt.
3. 2 gal.	**6.** 4 gal. 3 qt.	**9.** 2 gal. 1 pt.

Change to gallons:

10. 80 qt.	**12.** 24 qt.	**14.** 96 pt.
11. 36 qt.	**13.** 88 pt.	**15.** 120 pt.

Change to quarts:

16. 16 pt.	**18.** 17 pt.	**20.** 48 pt.
17. 4 gal.	**19.** $2\frac{1}{2}$ gal.	**21.** 6 gal.

22. What will 2 gallons of milk cost at 10 cents a quart?

23. What will 12 quarts of gasoline cost at 18 cents a gallon?

24. At \$1.10 a gallon how much will 6 quarts of oil cost?

2 pints (pt.)	=	**1 quart (qt.)**
8 qt.	=	**1 peck (pk.)**
4 pk.	=	**1 bushel (bu.)**

Change to quarts:

1. 2 bushels
2. 1 bushel and 2 pecks
3. 16 pints
4. 6 pecks
5. $2\frac{1}{4}$ bushels

Change to bushels:

6. 48 quarts
7. 22 pecks
8. 64 pints
9. 104 quarts
10. 35 pecks

Change:

11. 24 pints to pecks
12. 17 pecks to quarts
13. $3\frac{1}{2}$ bushels to pecks
14. 8 qt. and 4 pt. to pecks
15. 1 bushel to pints
16. $2\frac{1}{2}$ pecks to pints

17. If a fruit dealer sells $2\frac{1}{2}$ bushels of berries by the quart, how many quarts does he sell?

18. If a bag of grain contains 96 quarts, how many bushels are there in 5 of these bags?

19. A huckster sells potatoes for 35 cents a peck. How much money will he receive for $4\frac{1}{2}$ bushels?

12 inches	**= 1 foot**
3 feet	**= 1 yard**

Change:

1. 72 inches to yards
2. 16 yards to feet
3. $3\frac{1}{2}$ yards to inches
4. 16 feet to yards
5. 288 inches to feet
6. 2 yards and 1 foot to inches
7. 6 inches to feet
8. 7 yards to feet
9. 51 feet to yards
10. 8 yards to inches

11. John's desk is 40 inches long. Express its length in feet and inches.

12. Our schoolroom is 24 feet wide. How many yards wide is it?

13. A window is 6 feet high and 3 feet wide. How many feet is it around the window? How many yards?

14. The blackboard is 6 yards long and 1 yard wide. Find the distance around the blackboard.

15. How many yards are there in 111 feet?

16. A stick is 1 yard and 2 feet long. Express its length in inches.

17. Mr. Robinson plants a garden 24 feet long and 15 feet wide. How many yards is it around Mr. Robinson's garden?

18. A piece of string is 2 feet long. What part of a yard is that? How many inches long is the string?

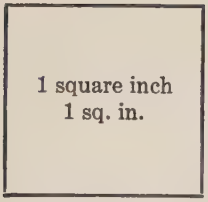


FIG. 1

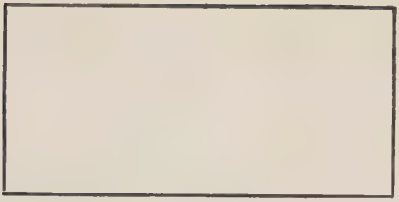


FIG. 2

1. What is the form of Figure 1? How long is it? How wide?

What is it called? Describe a **square inch** (*sq. in.*).

2. Without a rule, draw a square inch. Measure and correct it.

3. The corners of a square are *right angles*. This is a right angle ⌊. How many right angles has a square?

4. What kind of angles has Figure 2?

5. How many right angles has Figure 1? Figure 2?

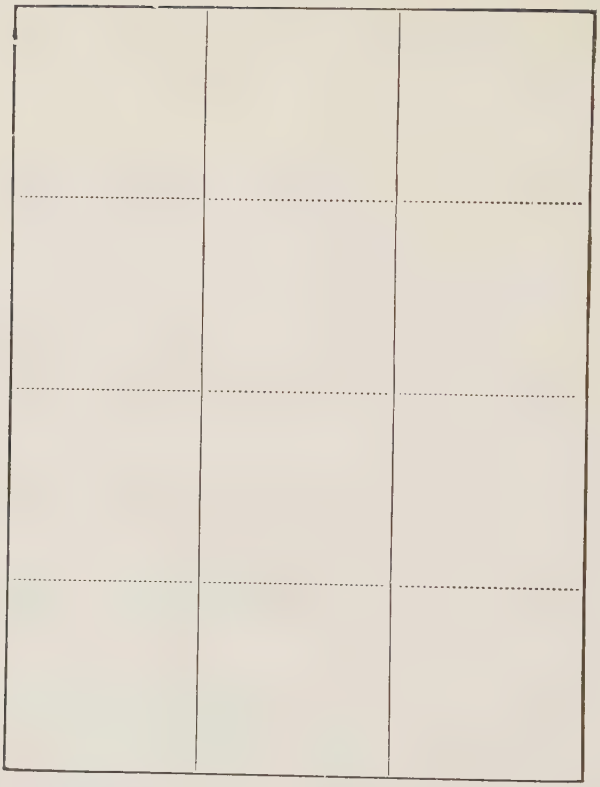
6. Figure 1 and Figure 2 are **rectangles**. Describe a rectangle.

7. A rectangle may be either square or oblong. Make an oblong rectangle 3 in. long and 1 in. wide. Draw lines cutting it into square inches. How many square inches are there?

8. Find the number of square inches in a rectangle 1 inch wide and 3 inches long.

9. Draw a rectangle three inches long and 2 inches wide. Mark it off into square inches and count them.

10. Draw a rectangle 4 in. long and 3 in. wide. Mark it off into square inches and count them.



1. What is the name of this figure? How wide is it? How long?

2. The dotted lines drawn from left to right divide the rectangle into parts. How long and how wide *are these parts?* How many are there of them?

3. Each rectangle 4 in. long and 1 in. wide contains how many square inches? How many square inches are there in all of them?

1. Draw a rectangle which you think is 6 in. by 5 in. Measure and correct it. Mark out a row of square inches along one side of it. How many square inches are there in this row? How many such rows could you make from the whole rectangle? How many square inches are there in the rectangle?

2. Make a rectangle 7 in. by 4 in. Mark it off into square inches. How many square inches are there in the rectangle?

3. Make a rectangle 8 in. by 6 in. How many square inches does it contain?

4. On the blackboard, draw a rectangle 18 in. by 7 in. How many square inches does it contain?

5. How many square inches are there in a rectangle 24 in. by 12 in.? Make the drawing.

6. Find the number of square inches in the top of a table which is 22 in. by 38 in.

Find the number of square inches in each of the following rectangles:

7. 39 in. by 42 in.
8. 68 in. by 29 in.
9. 47 in. by 33 in.
10. 59 in. by 28 in.
11. 39 in. by 2 ft.
12. 62 in. by 37 in.
13. 41 in. by 48 in.
14. 36 in. by 19 in.
15. 38 in. by 40 in.
16. 3 ft. by 20 in.

17. Draw a square 12 in. long and 12 in. wide. How many square inches does it make?

18. What should a square 1 ft. long and 1 ft. wide be called? A square 1 yd. long and 1 yd. wide?

144 square inches = 1 square foot
9 square feet = 1 square yard

Change to square feet:

1. 4 sq. yd.
2. 720 sq. in.
3. 504 sq. in.
4. 7 sq. yd.
5. 1440 sq. in.
6. $2\frac{1}{3}$ sq. yd.

Change to square inches:

7. 3 sq. ft.
8. 2 sq. yd.
9. 5 sq. ft.
10. $\frac{1}{2}$ sq. ft.
11. 3 sq. yd.
12. 8 sq. ft.

Change to square yards:

13. 63 sq. ft.
14. 90 sq. ft.
15. 45 sq. ft.
16. 180 sq. ft.
17. 72 sq. ft.
18. 27 sq. ft.

Draw a rectangle 5 inches long and 4 inches wide. Its *area* is 20 square inches. Its *perimeter* or distance around is 18 inches.

19. A room is 32 feet long and 10 feet wide. What is the area of the floor? What is the perimeter?

20. Find the number of square feet in a city lot 50 ft. by 150 ft.

21. Find the number of square yards in a carpet 4 yards by 5 yards.

22. A rectangle is 18 inches long and 16 inches wide. What is its area in square feet?

23. A baseball diamond is a square 90 feet on a side. Find its area in square feet. Find its perimeter.

24. Find the number of square yards in a rug 9 ft. by 12 ft.

60 seconds	=	1 minute
60 minutes	=	1 hour
24 hours	=	1 day
7 days	=	1 week
52 weeks	=	1 year
12 months	=	1 year

Change:

1. 330 seconds to minutes.
2. 504 hours to weeks.
3. 2880 minutes to days.
4. $1\frac{1}{2}$ days to minutes.
5. 3 years to months.
6. 500 minutes to hours.
7. $2\frac{1}{4}$ hours to seconds.
8. $2\frac{1}{2}$ years to months.
9. 1 week to hours.
10. 720 hours to days.

11. What part of a day is 720 minutes?

12. If it takes a contractor $2\frac{1}{3}$ years to construct a large building, how many months does it take him?

13. A newsboy needs $2\frac{1}{4}$ hours to peddle his papers. How many minutes does it take him?

14. The World War lasted 4 years and 3 months. How many months did it last?

15. If a horse can trot a mile in 2 minutes and 7 seconds, how many seconds does it take?

16. Mr. Essex charged his storage battery for 48 hours continuously. How many days did he charge it?

17. How many months were there between January 1, 1775, and January 1, 1781?

16 ounces	**=**	**1 pound**
100 pounds	**=**	**1 hundredweight (cwt.)**
2000 pounds	**=**	**1 ton**

Change:

1. 1600 lb. to cwt.
2. 48 ounces to pounds.
3. 4500 pounds to tons.
4. 10 cwt. to tons.
5. 200 pounds to ounces.
6. 4 T. to cwt.
7. 1 cwt. to ounces.
8. 40 ounces to pounds.
9. $4\frac{1}{4}$ pounds to ounces.
10. $\frac{1}{2}$ ton to ounces.

11. Mr. Hovey sells $2\frac{1}{4}$ lb. of meat. How many ounces does he sell?

12. A coal merchant sells 24 hundredweight of coal. How many tons does he sell?

13. If a small loaf of bread weighs 12 ounces, what part of a pound does it weigh?

14. A grain dealer sells a farmer $4\frac{1}{2}$ tons of grain. That is how many hundredweight?

15. If a shipment of hardware weighs 16 hundredweight, what part of a ton does it weigh?

16. Express 24 ounces as pounds.

17. Change 15 lb. to ounces.

18. A load of brick weighs $1\frac{1}{2}$ tons. How many hundredweight are there in the load?

19. Change 20 tons to pounds.

20. From a load of potatoes weighing 2400 pounds, one half a ton is sold. How many pounds remain unsold?

5 cents	=	1 nickel
10 cents	=	1 dime
50 cents	=	1 half dollar
25 cents	=	1 quarter dollar
100 cents	=	1 dollar
10 dimes	=	1 dollar

Change:

1. 1 half dollar to dimes.
2. 3 quarter dollars to nickels.
3. 2 dollars to quarter dollars.
4. 200 cents to dimes.
5. 4 half dollars to quarter dollars.
6. $2\frac{1}{2}$ dollars to dimes.
7. 1 dollar to nickels.
8. 3 half dollars to dimes.
9. 10 nickels to quarter dollars.
10. 20 dimes to half dollars.
11. How many nickels are worth as much as 1 quarter and 4 dimes?
12. A boy buys a pound of candy and gives the clerk 1 half dollar and 2 dimes. How many nickels would it have taken to equal the same amount of money?
13. How many cents are equal to 4 dimes, 1 quarter dollar, and 2 nickels?
14. A messenger boy was sent to change 10 dollars, 15 half dollars, and 10 dimes to quarter dollars. How many quarter dollars should he have received?

BILLS AND ACCOUNTS

Mr. Smith buys articles at the grocery store during the week, and pays for them on Saturday. The merchant keeps an **account**, or record, of Mr. Smith's purchases. One week in March, Mr. Smith's account in the merchant's book was as follows:

Henry Smith

Mar.	*19*	*3 cans corn,*	*25*		*75*		
	20	*2 doz. eggs,*	*42*		*84*		
		4 lb. butter,	*48*	*1*	*92*		

On Saturday, March 21, Mr. Smith went to the store. The bookkeeper gave him the following **bill**:

SYRACUSE, N. Y., *Mar. 21*, 1925

J. H. WILLIAMS

Plain and Fancy Groceries

Sold to *Henry Smith*

Mar.	*19*	*3 cans corn,*	*@ 25¢*		*75*		
	20	*2 doz. eggs,*	*@ 42¢*		*84*		
		4 lb. butter,	*@ 48¢*	*1*	*92*	*3*	*51*

Mr. Smith examined the bill, found the **footing**, $3.51, to be correct, and paid the amount.

The bookkeeper stamped the bill PAID, signed Mr. Williams' name, his own initials and the date. He gave the receipted bill to Mr. Smith.

The bookkeeper might have written the words " received payment " instead of the stamp had he wished to do so.

SYRACUSE, N. Y., ...19..

J. H. WILLIAMS

Plain and Fancy Groceries

Sold to_____

If you were the bookkeeper for J. H. Williams you would be supplied with blank **billheads** like the above.

Make blank billheads and upon them make out bills for the following customers. Supply the dates.

1. Mr. Henry Axtell,
   12 bars soap @ 7¢
   10 pounds rice @ 11¢
2. Mr. William White,
   5 pounds sugar @ 11¢
   2 doz. oranges @ 30¢
3. Mr. Charles Coy,
   5 lb. butter @ 40¢
   2 packages crackers @ 10¢
   2 boxes sardines @ 15¢
4. Mr. Jos. Dimond,
   1 gal. vinegar @ 12¢
   5 lb. raisins @ 24¢
   3 cans salmon @ 22¢
   2 lb. cheese @ 15¢

AFTON, N. Y., ...19..

WILL HALL

Glenside Farm

Sold to_____

Make out Mr. Hall's bills for the following. Supply customers' names and the dates. Foot the bills and receipt them.

1. 8 quarts of milk at 9¢; 3 pints of cream at 40¢; 4 pounds of butter at 42¢; 8 pounds of cheese at 30¢.

2. 2 pecks (pk.) of onions at 55¢; 4 bushels (bu.) of potatoes at $.90; 3 doz. eggs at 40¢; 2 bu. apples at $1.75.

ERIE, PA., ...19..

*Mr.*_____

In account with G. L. PRATT

HOUSE FURNISHINGS

Make out Mr. Pratt's bills for the following, supplying names and dates. Foot and receipt them.

3. 3 kitchen chairs at $1.25; 1 kitchen table at $2.50; 1 kitchen cabinet at $28.50; 1 gas range at $24.50.

HOMER, N. Y.,.....19..

C. R. MERRILL

Men's Furnishings

Sold to_____

Make out Mr. Merrill's bills for the following. Supply customers' names and the dates. Foot the bills and receipt them.

1. 1 neck scarf at $4.50, 3 pairs of hose at 98 cents, 2 pairs of overalls at $2.20, 4 cotton shirts at $1.75.

2. 2 scarf pins at $2.49, 1 cap at $2.00, 3 pairs of canvas gloves at 25 cents, 4 neckties at 89 cents.

SCRANTON, PA.,.....19..

ROE & DOUBLEDAY

Drygoods

Sold to_____

Make out Roe & Doubleday's bills for the following.

3. 4 spools of thread @ 5 cents, 7 yards of silk @ $1.70, 1 dress @ $16.49, 2 pairs of stockings @ 76 cents.

4. 8 yards of cloth @ 19 cents, 2 pairs of lace curtains @ $3.80, 4 aprons @ $1.10, 4 packages of pins @ 8 cents.

Here is a college boy's account for one week.

1925		Receipts			1925		Expenditures		
Feb.	*1*	*Bal. brought for'd from January*	*3*	*17*	*Feb.*	*2*	*Board for January*	*28*	*00*
Feb.	*3*	*Check from Father*	*40*	*00*	*Feb.*	*3*	*Street-car tickets*		*35*
Feb.	*4*	*Work in Library*	*12*	*50*	*Feb.*	*4*	*Laundry*	*2*	*15*
Feb.	*7*	*Tutoring*	*10*	*00*	*Feb.*	*6*	*Gym fee*	*5*	*00*
							Student tax	*2*	*75*
							Railroad fare	*12*	*00*
					Feb.	*7*	*Theater tickets*	*4*	*00*
					Feb.	*8*	*Church*		*35*
							Balance Feb. 9	*11*	*07*
			65	*67*				*65*	*67*

If this boy's expenditures had been greater than his receipts, the "balance" would have been written in the other column.

Rule your paper and make out accounts for the following transactions, showing the balance in each case, supplying the dates.

1. Mrs. Arthur, during one week in June, spent \$8.25 for groceries, 60 cents for ice, \$2.10 for a gas bill, \$1.50 for a long-distance telephone call, \$1.25 for an electric bill, \$1.75 for laundry. She had \$2.20 remaining from the preceding week, received \$15.00 for household expenses, and sold some early garden truck for \$2.15. Make out her account for the week.

2. William took a vacation trip. He had saved \$5.60 from his paper route; he earned \$2.10 running errands; his father gave him \$2.50 on his birthday. He spent \$2.20 for railroad fare; 80 cents for fishing bait, \$1.00 for rental of a boat, and \$4.00 for eatables. Make out his account.

Sales-Slips

When a person buys goods at a store, a *sales-slip* is usually given with the goods. This sales-slip shows what was bought, the cost, the date, and whether the articles were charged or sold for cash.

BROWN and VAN DUSEN
CHICAGO

April 4, 1925

Name *Mrs. R. B. Buell*
Address *247 Oak Ave.*
Sold by *No. 12*
Amount Received *$20.00*

2 yd.	*silk @ 1.80*	*3*	*60*
4 yd.	*satin @ 2.00*	*8*	*00*
		11	*60*

Make out sales-slip like the above for the following. Supply the names, dates, the amount received and the proper charge.

1. 3 lb. sirloin steak at 46¢; 2 lb. of bacon at 50¢; 4 lb. liver at 20¢.

2. 3 lb. of coffee at 45¢; 2 loaves of bread at 12¢; 2 cans of tomatoes at 25¢; 4 qt. of strawberries at 26¢.

3. 3 hammers at $1.25; 25 lb. nails at 7¢; 4 pairs of hinges at 48¢ a pair.

4. 2 bushels potatoes at 90¢; 4 cans of salmon at 21¢; 6 lb. of butter at 50¢.

Problems

1. William had \$24. He spent $\frac{1}{6}$ of it for a hat and $\frac{1}{4}$ of it for shoes. How much money had he left?

2. Mr. Hendrick bought $6\frac{3}{4}$ tons of bran, $2\frac{1}{2}$ tons of mixed feed, and $\frac{7}{8}$ ton of corn meal. Find the total number of tons of grain bought.

3. James buys oranges at the rate of 3 for 10 cents. How many can he buy for 50 cents?

4. A farmer sells his land at the rate of $\$87\frac{1}{2}$ an acre. If the farm brought him \$5250, find the number of acres.

5. Find the cost of $11\frac{1}{2}$ yards of silk at $\$2\frac{3}{4}$ a yard.

6. Mr. Dey bought wood for $\$3\frac{1}{2}$ a cord and sold it for $\$4\frac{1}{4}$ a cord. How much did he gain on $8\frac{1}{2}$ cords?

7. A milk dealer buys milk for \$2.99 a hundred pounds. How much does he pay for 8290 pounds?

8. Find the cost of 275 pounds of meat at $27\frac{1}{2}$ cents a pound.

9. A dealer in school supplies pays \$5.32 for tablets at \$.07 each. How many does he buy?

10. Mrs. Baker bought 7 yards of cloth at 29 cents a yard, $1\frac{1}{2}$ yards of silk at \$2.10 a yard, 1 pair of stockings at \$1.25 a pair. She gave the clerk a \$10 bill. How much change should she receive?

11. What will 264 oranges bring at 40 cents a dozen?

12. If grapefruit are sold 2 for 25 cents, how many can I buy for \$1?

13. A bushel of potatoes weighs 60 pounds. How many bushels are there in $1\frac{1}{2}$ tons of potatoes?

14. Find the cost of 6 dozen geographies at $\$1\frac{1}{4}$ each.

15. When eggs are 55 cents a dozen, how many dozen can be bought for $\$13\frac{3}{4}$?

16. Mrs. Carr bought of Reynolds & Co. 2 pounds of butter at 52 cents a pound, $1\frac{1}{2}$ pounds of cheese at 34 cents a pound, $2\frac{3}{4}$ pounds of meat at 28 cents a pound, and $1\frac{1}{4}$ pounds of frankfurters at 20 cents a pound. Make out the proper bill and receipt it.

17. How many pints are there in $2\frac{7}{8}$ gallons?

18. If a loaf of bread weighs 12 ounces, how many loaves are required to weigh 6 pounds?

19. A farmer owned a farm of 124 acres. He sold $\frac{3}{4}$ of it for $\$62\frac{1}{2}$ an acre, the rest for $75 an acre. Find the total value of the farm.

20. Find the cost of 168 gallons of gasoline at $18\frac{1}{2}$ cents a gallon.

21. A fruit dealer sells $1\frac{3}{4}$ bushels of berries at $.16 a quart. How much does he get for the berries?

22. A butcher buys meat at $17.50 a hundred pounds. How much does he pay for 375 pounds?

23. At $13.25 a ton what will 4800 pounds of coal cost?

24. How many nickels are equal to $10.25?

25. How many dimes are equal to $2.50?

26. How many cents are equal to $2.17?

27. Make out an account for Ralph as follows: Receipts — his cash on hand $2.10, weekly allowance 75 cents, paper route $1.05. Expenses — school club dues 40 cents, moving picture 20 cents, baseball $1.25, candy 10 cents.

Reading and Writing Numbers

Read the following numbers:

1. 291.7	3. 2,761,912	5. $1,812.16	7. 16.12
2. 10.791	4. 2,116.128	6. 212.004	8. 7.016

9. $7\frac{4}{5}$ 11. .12 13. 9.03 15. $14\frac{1}{4}$ 17. $212\frac{19}{25}$

10. $18\frac{7}{8}$ 12. .012 14. .027 16. 75.75 18. $4\frac{2}{3}$

Write in figures:

19. One thousand, eight hundred twelve; two hundred, one.

20. Seven thousand, eight; nineteen and seven eighths.

21. Twenty-four and six hundredths; eight fifteenths.

22. Nineteen thousand twelve; six thousandths.

23. Ten thousand, four hundred twelve; eleven and five tenths.

24. Seven hundred twenty and eighteen thousandths.

Change to decimals:

25. $\frac{4}{10}$ 27. $\frac{21}{1000}$ 29. $17\frac{3}{100}$ 31. $5\frac{1}{100}$ 33. $\frac{14}{1000}$

26. $\frac{12}{100}$ 28. $2\frac{6}{10}$ 30. $\frac{115}{1000}$ 32. $18\frac{2}{1000}$ 34. $1\frac{1}{1000}$

Change to fractions and mixed numbers:

35. .28	37. 2.4	39. 1.002	41. .007	43. 218.218
36. .006	38. 17.02	40. 4.06	42. .71	44. 11.716

45. Write in words: 1, 51, 49, 504, 5004.

46. Write the next year in words; your age; the date of your birth.

47. Write a mixed number; a decimal; a mixed decimal; an Arabic number.

Reduction

Change:

1. $\frac{1}{2}$ to 6ths; $\frac{1}{3}$ to 9ths; $\frac{1}{5}$ to 25ths; $\frac{1}{4}$ to 8ths; $\frac{3}{4}$ to 20ths.

Change to lowest terms:

2. $\frac{18}{20}$	4. $\frac{24}{75}$	6. $\frac{14}{16}$	8. $\frac{70}{100}$	10. $\frac{8}{12}$	12. $\frac{35}{49}$
3. $\frac{16}{24}$	5. $\frac{25}{40}$	7. $\frac{10}{15}$	9. $\frac{17}{34}$	11. $\frac{9}{12}$	13. $\frac{10}{25}$

Change to fractions:

14. $4\frac{2}{3}$	16. $17\frac{1}{2}$	18. $19\frac{1}{5}$	20. $33\frac{1}{3}$	22. $8\frac{9}{10}$	24. $7\frac{3}{5}$
15. $5\frac{7}{8}$	17. $4\frac{5}{8}$	19. $12\frac{1}{2}$	21. $1\frac{2}{5}$	23. $66\frac{2}{3}$	25. $8\frac{1}{4}$

Change to mixed numbers:

26. $\frac{85}{7}$	28. $\frac{64}{5}$	30. $\frac{29}{3}$	32. $\frac{17}{4}$	34. $\frac{14}{3}$	36. $\frac{17}{2}$
27. $\frac{25}{2}$	29. $\frac{27}{4}$	31. $\frac{15}{2}$	33. $\frac{27}{10}$	35. $\frac{38}{5}$	37. $\frac{5}{4}$

Find the L. C. D:

38. $\frac{2}{3}, \frac{3}{4}$	40. $\frac{5}{8}, \frac{1}{5}$	42. $\frac{1}{3}, \frac{3}{8}$	44. $\frac{1}{3}, \frac{1}{4}, \frac{2}{5}$	46. $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}$	
39. $\frac{1}{5}, \frac{3}{10}$	41. $\frac{2}{5}, \frac{2}{3}$	43. $\frac{1}{2}, \frac{2}{3}$	45. $\frac{2}{3}, \frac{2}{5}, \frac{1}{2}$	47. $\frac{5}{8}, \frac{1}{2}, \frac{2}{3}$	

Change to decimals:

48. $\frac{3}{8}$	50. $\frac{8}{25}$	52. $\frac{4}{5}$	54. $10\frac{5}{8}$	56. $20\frac{1}{8}$	58. $3\frac{1}{4}$
49. $\frac{1}{16}$	51. $6\frac{2}{5}$	53. $\frac{15}{20}$	55. $8\frac{3}{4}$	57. $5\frac{3}{5}$	59. $\frac{5}{20}$

Change to fractions in lowest terms:

60. .005	62. .375	64. .625	66. .75	68. .125	70. .875
61. .25	63. .6	65. .8	67. .05	69. .015	71. .35

Change to next lower denomination:

72. 7 ft.	74. 3 days	76. 10 minutes	78. 7 cwt.
73. 5 gal.	75. 4 dimes	77. 8 sq. ft.	79. 8 qt.

Addition

Add:

1.
18
27
42
81
99
16
28
34
42

2.
43
80
62
77
12
29
35
87
49

3.
$1.18
3.27
9.04
2.11
7.19
6.25
4.17
1.29
8.61

4.
2.07
.125
8.09
1.12
8.5
6.174
2.98
7.615
8.08

5. $18 + 16 + 39 = ?$
6. $27 + 81 + 24 = ?$
7. $16 + 91 + 86 = ?$
8. $25 + 49 + 77 = ?$

9. $88 + 12 + 42 = ?$
10. $19 + 29 + 37 = ?$
11. $16 + 12 + 91 = ?$
12. $27 + 34 + 41 = ?$

13. $80 + 20 + 10 + 90 = ?$
14. $60 + 40 + 90 + 20 = ?$
15. $80 + 40 + 70 + 50 + 30 = ?$
16. $20 + 10 + 60 + 30 + 20 = ?$

17. $\frac{2}{3}+\frac{1}{4}=?$ **19.** $\frac{1}{4}+\frac{1}{2}=?$ **21.** $\frac{1}{2}+\frac{5}{6}=?$ **23.** $\frac{1}{2}+\frac{3}{4}+\frac{2}{3}=?$
18. $\frac{3}{5}+\frac{1}{2}=?$ **20.** $\frac{7}{8}+\frac{1}{3}=?$ **22.** $\frac{2}{3}+\frac{2}{5}=?$ **24.** $\frac{1}{2}+\frac{1}{3}+\frac{2}{5}=?$

25.
$4\frac{1}{2}$
$2\frac{2}{3}$

26.
$7\frac{7}{8}$
$2\frac{1}{2}$

27.
$1\frac{3}{5}$
$2\frac{1}{3}$

28.
$4\frac{1}{3}$
$1\frac{3}{4}$

29.
2.017
.16

30.
.185
.064

31.
$.66\frac{2}{3}$
$.33\frac{1}{3}$

32.
$.87\frac{1}{2}$
$.12\frac{1}{2}$

33. $2\frac{1}{2} + 4\frac{7}{8} = ?$ **35.** $4\frac{1}{10} + 3\frac{1}{2} = ?$ **37.** $4\frac{1}{5} + 1\frac{1}{2} = ?$
34. $1\frac{1}{3} + 2\frac{1}{4} = ?$ **36.** $2\frac{1}{5} + 2\frac{1}{3} = ?$ **38.** $7\frac{1}{2} + 6\frac{2}{3} = ?$

Add:

1.	2.	3.	4.
421	726	864.342	76543
612	834	62.7	65432
102	697	432.5	76543
430	243	192.61	87654
996	901	47.531	89765
212	187	1.002	32109
708	726	851.293	45678
625	820	367.654	54817
821	875	135.86	43386
416	913	513.51	64215
113	205	602.75	21502

5.	6.	7.	8.
$24\frac{1}{4}$	$94\frac{3}{4}$	$21\frac{1}{5}$	$26\frac{3}{4}$
$64\frac{9}{20}$	$18\frac{7}{10}$	$78\frac{11}{20}$	$89\frac{1}{5}$

9.	10.	11.	12.
$47\frac{1}{5}$	$411\frac{17}{20}$	$12\frac{3}{4}$	$294\frac{4}{5}$
$28\frac{2}{3}$	$26\frac{3}{4}$	$41\frac{3}{5}$	$761\frac{1}{2}$

13.	14.	15.	16.
$17\frac{4}{5}$	$781\frac{3}{4}$	$19\frac{11}{20}$	$918\frac{1}{6}$
$83\frac{3}{4}$	$16\frac{2}{3}$	$88\frac{3}{5}$	$219\frac{1}{4}$

17.	18.	19.	20.
$219\frac{7}{8}$	$128\frac{7}{10}$	$284\frac{2}{5}$	$61\frac{3}{5}$
$62\frac{3}{4}$	$731\frac{1}{2}$	$751\frac{2}{3}$	$88\frac{3}{4}$

21. Add twenty-five and fourteen thousandths, seventeen and fifteen hundredths, forty-three and nine thousandths, nine and nine tenths, twelve and five hundredths.

22. Add 365.005 + 234.55 + 489.231 + 865.2 + 204.123.

Subtraction

Subtract:

1. 9,826,432 3,148,269	**2.** 26,819,412 17,326,817	**3.** 2,716,895 1,145,268

4. $80-20=?$	**6.** $60-40=?$	**8.** $90-70=?$
5. $160-140=?$	**7.** $180-60=?$	**9.** $300-150=?$
10. $28-12=?$	**12.** $62-41=?$	**14.** $89-47=?$
11. $78-38=?$	**13.** $97-54=?$	**15.** $38-15=?$
16. $.42-.13=?$	**18.** $.48-.11=?$	**20.** $.75-.35=?$
17. $.80-.55=?$	**19.** $.24-.08=?$	**21.** $.50-.15=?$

The correct change for \$.36 from \$1.00 is 4 cents, 1 dime, and 1 half dollar. \$.04 + \$.10 + \$.50 = \$.64. \$1.00 − \$.36 = \$.64.

Find the correct change from \$1.00 for purchases amounting to:

22. \$.24	**24.** \$.20	**26.** \$.39	**28.** \$.51	**30.** \$.10
23. \$.18	**25.** \$.76	**27.** \$.69	**29.** \$.87	**31.** \$.82

Subtract:

32. \$67289.19 19482.07	**33.** 247,196 141,218	**34.** \$24691.87 20291.19	**35.** 867.291 247.628

36. From forty-nine and two hundred seven thousandths, subtract sixteen and one hundred ninety-two thousandths.

37. Subtract twenty-four and seven hundred eighteen thousandths from fifty and eight hundred nine thousandths.

Multiplication

Multiply:

1. $89 \times 10 = ?$
2. $16 \times 20 = ?$
3. $49 \times 60 = ?$
4. $82 \times 50 = ?$
5. $61 \times 20 = ?$
6. $12 \times 80 = ?$
7. $27 \times 70 = ?$
8. $98 \times 90 = ?$
9. $76 \times 60 = ?$
10. $82 \times 50 = ?$
11. $91 \times 700 = ?$
12. $62 \times 400 = ?$
13. $17 \times 900 = ?$
14. $21 \times 100 = ?$
15. $47 \times 600 = ?$
16. $27.52 \times 10 = ?$
17. $82.43 \times 10 = ?$
18. $3.218 \times 10 = ?$
19. $.716 \times 10 = ?$
20. $.019 \times 10 = ?$
21. $2.891 \times 100 = ?$
22. $.728 \times 100 = ?$
23. $347.171 \times 100 = ?$
24. $42.62 \times 1000 = ?$
25. $8.629 \times 1000 = ?$

Multiply:

26. $\frac{3}{8} \times 7 = ?$
27. $\frac{5}{6} \times 9 = ?$
28. $\frac{9}{10} \times 25 = ?$
29. $\frac{7}{8} \times 60 = ?$
30. $\frac{11}{20} \times 95 = ?$
31. $\frac{2}{3} \times 64 = ?$
32. $\frac{5}{8} \times 100 = ?$
33. $\frac{7}{16} \times 72 = ?$
34. $\frac{3}{5} \times 200 = ?$
35. $\frac{3}{4} \times 42 = ?$
36. $\frac{7}{20} \times 88 = ?$
37. $\frac{2}{5} \times 41 = ?$
38. $2\frac{1}{5} \times 25 = ?$
39. $7\frac{1}{4} \times 16 = ?$
40. $4\frac{5}{6} \times 30 = ?$
41. $12\frac{1}{2} \times 12 = ?$
42. $16\frac{2}{3} \times 6 = ?$
43. $33\frac{1}{3} \times 12 = ?$
44. $8\frac{2}{3} \times 9 = ?$
45. $20\frac{5}{6} \times 12 = ?$
46. $15\frac{3}{8} \times 32 = ?$
47. $7\frac{3}{5} \times 10 = ?$
48. $6\frac{2}{3} \times 18 = ?$
49. $2\frac{1}{2} \times 22 = ?$

Multiply:

50. $\frac{2}{3} \times \frac{3}{4} = ?$
51. $\frac{3}{5} \times \frac{1}{3} = ?$
52. $\frac{7}{8} \times \frac{4}{5} = ?$
53. $\frac{1}{2} \times \frac{1}{3} = ?$
54. $\frac{2}{5} \times \frac{5}{8} = ?$
55. $\frac{1}{2} \times \frac{7}{8} = ?$
56. $\frac{3}{7} \times \frac{7}{9} = ?$
57. $\frac{3}{8} \times \frac{2}{5} = ?$
58. $\frac{7}{20} \times \frac{5}{8} = ?$
59. $\frac{1}{2} \times \frac{20}{25} = ?$
60. $\frac{4}{25} \times \frac{3}{4} = ?$
61. $\frac{6}{10} \times \frac{5}{6} = ?$

Multiply:

1. 219×407
2. 672×912
3. 812×809
4. 963×604
5. 613×248
6. 194×580
7. 504×380
8. 526×940
9. $\$20.10 \times 70$
10. $\$3.16 \times 800$
11. $\$423 \times 2500$
12. $\$7.04 \times 38$
13. $5.11 \times .8$
14. $571.5 \times .05$
15. 31.08×2.1
16. $51.63 \times .1$
17. $601.3 \times .06$
18. 4.52×6.3
19. 26.21×61.7
20. $963.1 \times .25$
21. 37.5×3.75
22. $4.27 \times .9$
23. $86.45 \times .7$
24. $267.8 \times .19$

Multiply. Use short process whenever possible:

25. $\$480 \times .25$
26. $\$960 \times .66\frac{2}{3}$
27. $\$135 \times .33\frac{1}{3}$
28. $\$888 \times .87\frac{1}{2}$
29. $\$850 \times .20$
30. $\$240 \times .37\frac{1}{2}$
31. $\$576 \times .50$
32. $\$848 \times .40$
33. $\$600 \times 1.33\frac{1}{3}$
34. $\$250 \times 1.25$
35. $\$630 \times 1.37\frac{1}{2}$
36. $\$450 \times 1.12\frac{1}{2}$

Multiply. Change answers to simplest form:

37. $\frac{5}{8} \times 12$
38. $\frac{4}{5} \times 75$
39. $\frac{7}{15} \times 20$
40. $\frac{14}{25} \times 30$
41. $\frac{9}{10} \times 85$
42. $\frac{5}{8} \times 6$
43. $1\frac{3}{25} \times 5$
44. $\frac{7}{8} \times 60$
45. $1\frac{1}{25} \times 15$
46. $\frac{2}{3} \times 36$
47. $\frac{9}{20} \times 4$
48. $\frac{7}{25} \times 25$
49. $\frac{3}{4} \times 30$
50. $\frac{5}{6} \times 3$
51. $\frac{7}{10} \times 75$
52. $\frac{7}{8} \times 12$

Cancel when possible:

53. $\frac{5}{6} \times \frac{3}{4} \times \frac{3}{10}$
54. $\frac{4}{5} \times \frac{6}{8} \times \frac{8}{15}$
55. $\frac{8}{9} \times \frac{3}{4} \times \frac{5}{16}$
56. $\frac{3}{5} \times \frac{10}{15} \times \frac{5}{8}$
57. $\frac{3}{5} \times \frac{1}{2} \times \frac{2}{3}$
58. $\frac{3}{8} \times \frac{4}{15} \times \frac{2}{3}$
59. $\frac{3}{4} \times \frac{4}{5} \times \frac{5}{6} \times \frac{6}{7}$
60. $\frac{5}{8} \times 1\frac{6}{25} \times \frac{1}{2} \times \frac{4}{5}$
61. $\frac{9}{10} \times \frac{4}{5} \times \frac{8}{25} \times \frac{5}{16}$

Multiply:

62. $2\frac{1}{2} \times 6\frac{2}{3}$
63. $4\frac{4}{5} \times 7\frac{3}{4}$
64. $5\frac{5}{8} \times 1\frac{7}{10}$
65. $5\frac{6}{7} \times 2\frac{5}{6}$
66. $5\frac{2}{3} \times 2\frac{3}{4}$

Division

Divide:

1. $60\overline{)360}$	**4.** $90\overline{)630}$	**7.** $50\overline{)3500}$	**10.** $600\overline{)72000}$
2. $70\overline{)490}$	**5.** $60\overline{)420}$	**8.** $80\overline{)7200}$	**11.** $400\overline{)16000}$
3. $80\overline{)480}$	**6.** $40\overline{)480}$	**9.** $40\overline{)2000}$	**12.** $700\overline{)21000}$

Divide:

13. $17.84 \div 10$	**16.** $82.912 \div 100$	**19.** $429.627 \div 1000$
14. $1.247 \div 10$	**17.** $.176 \div 100$	**20.** $8.219 \div 1000$
15. $.067 \div 10$	**18.** $2.416 \div 100$	**21.** $.624 \div 1000$

Divide. Write the answer in simplest form:

22. $\frac{8}{25} \div 4$	**25.** $\frac{12}{20} \div 6$	**28.** $\frac{7}{8} \div 10$	**31.** $\frac{3}{8} \div 12$
23. $\frac{5}{8} \div 25$	**26.** $\frac{3}{4} \div 7$	**29.** $\frac{15}{16} \div 1$	**32.** $\frac{3}{10} \div 9$
24. $\frac{2}{3} \div 12$	**27.** $\frac{4}{5} \div 6$	**30.** $\frac{7}{10} \div 14$	**33.** $\frac{5}{6} \div 25$
34. $?\times 12 = 24$	**38.** $5\times ? = 20$	**42.** $\frac{1}{5}$ of $? = 8$	
35. $?\times 24 = 12$	**39.** $.5\times ? = 20$	**43.** $5\times ? = 40$	
36. $?\times 25 = 100$	**40.** $\frac{1}{10}$ of $? = 60$	**44.** $?\times 7 = 14$	
37. $?\times 100 = 25$	**41.** $?\times 600 = 60$	**45.** $?\times 14 = 7$	

46. When 12 bushels of potatoes cost \$15, what is the price of 1 bushel?

47. What part of \$40 is \$5?

48. When 15 tons of hay bring \$315, what is the price of 1 ton?

49. James spent 20 cents, which was $\frac{1}{4}$ of all his money. How much money had he?

50. How much is $37\frac{1}{2}$ of \$96?

51. When 8 pounds of meat cost \$2.24, what does 1 pound cost?

Divide:

1. 55,232 by 64
2. 11,043 by 27
3. 22,700 by 45
4. 33,235 by 85
5. 272,688 by 437
6. 272,688 by 624
7. 580,110 by 634
8. 81,263 by 247
9. \$185.31 by 213
10. \$73.44 by 24
11. \$53.90 by 14
12. \$50.19 by 21

13. $.288 \div .64 = ?$
14. $.36 \div 60 = ?$
15. $144 \div .12 = ?$
16. $.12 \div 30 = ?$
17. $125 \div .12\frac{1}{2} = ?$
18. $1.225 \div 4.9 = ?$
19. $384.526 \div 1.16 = ?$
20. $315.432 \div .132 = ?$

Divide. Use short process whenever possible:

21. $\$15 \div \$.33\frac{1}{3} = ?$
22. $\$125 \div \$.75 = ?$
23. $\$200 \div \$.25 = ?$
24. $\$38 \div \$.16\frac{2}{3} = ?$
25. $\$720 \div \$66\frac{2}{3} = ?$
26. $\$15 \div \$37\frac{1}{2} = ?$
27. $\$45 \div \$1.25 = ?$
28. $\$140 \div \$2.33\frac{1}{3} = ?$

Divide. Write answers in simplest form:

29. $2\frac{4}{5} \div 12 = ?$
30. $\frac{7}{8} \div 49 = ?$
31. $1\frac{5}{16} \div 5 = ?$
32. $\frac{4}{5} \div 12 = ?$
33. $1\frac{1}{15} \div 11 = ?$
34. $\frac{9}{10} \div 3 = ?$
35. $\frac{4}{9} \div 2 = ?$
36. $1\frac{4}{15} \div 7 = ?$
37. $1\frac{8}{20} \div 9 = ?$

Cancel when possible:

38. $\frac{5}{8} \div \frac{3}{5} = ?$
39. $\frac{6}{7} \div \frac{6}{10} = ?$
40. $2\frac{8}{25} \div \frac{9}{10} = ?$
41. $1\frac{5}{21} \div \frac{5}{7} = ?$
42. $\frac{7}{9} \div \frac{3}{4} = ?$
43. $\frac{5}{8} \div \frac{4}{5} = ?$
44. $1\frac{2}{25} \div \frac{3}{5} = ?$
45. $\frac{7}{8} \div \frac{1}{2} = ?$
46. $1\frac{0}{16} \div \frac{5}{8} = ?$
47. $2\frac{1}{4} \div 3\frac{2}{3} = ?$
48. $15 \div 4\frac{1}{5} = ?$
49. $4\frac{1}{2} \div \frac{3}{8} = ?$
50. $4\frac{1}{8} \div 5\frac{1}{4} = ?$
51. $2\frac{1}{3} \div 2\frac{1}{5} = ?$
52. $6 \div 2\frac{1}{3} = ?$
53. $5\frac{1}{2} \div 2\frac{3}{4} = ?$
54. $36 \div 2\frac{1}{12} = ?$
55. $\frac{5}{8} \div 3\frac{1}{4} = ?$

Make and solve problems using the following:

1. \$9.23 cost
1.48 gain
selling price

2. \$375.50 cost
325.25 selling price
loss

3. \$976.67 cost
80.75 loss
selling price

4. \$195.62 spent
78.91 saved
earned

5. \$854.70 cost
68.40 loss
?

6. \$97.20 cost
90.40 ?
loss

7. \$350.50 loss
2780.20 selling price
?

8. \$25.68 earned
21.37 spent
saved

9. \$89.04 selling price
9.64 gain
cost

10. \$1078.95 selling price
178.13 gain
?

11. \$ 27.19 loss
179.43 selling price
cost

12. \$4775.50 earned
964.75 saved
spent

13. \$597.37 selling price
489.19 cost
gain

14. \$98.56 selling price
87.75 ?
gain

15. Gain \$200; cost \$2000; selling price?

16. Selling price \$110; cost \$90; gain?

17. Loss \$15; cost \$90; selling price?

18. Loss \$300; selling price \$1700; cost?

19. Gain \$450; selling price \$2500; cost?

Mental Tests

1

1. One half of a number is 2. What is the number?
2. Find the cost of $\frac{1}{2}$ lb. butter at 42¢ per pound.
3. Divide $\frac{2}{5}$ by 2.
4. Two divided by $\frac{1}{2}$ equals what?
5. What is $\frac{1}{2}$ of two?
6. Add $\frac{1}{4}$ and $\frac{1}{2}$.
7. Find the cost of 8 yards of cloth at $\$2\frac{1}{2}$ a yard.
8. What must be paid for 2 cords of wood at $\$4\frac{1}{2}$ a cord?
9. How many boxes of candy at $\$\frac{1}{4}$ each can be purchased for $2?
10. Subtract $\frac{1}{6}$ from $\frac{1}{3}$.

2

1. What is $\frac{1}{3}$ of 3?
2. Divide 3 by $\frac{1}{3}$.
3. Add $\frac{1}{3}$ and $\frac{1}{2}$.
4. One fourth of a number is 3. What is the number?
5. Divide $\frac{3}{4}$ by 3.
6. Find the sum of $3, $7, $4, $6, and $5.
7. Subtract $\frac{1}{5}$ from $\frac{1}{2}$.
8. Find the cost of $\frac{3}{4}$ lb. meat at 32¢ per pound.
9. Change 6 to 5ths.
10. Reduce $\frac{21}{63}$ to lowest terms.

3

1. Find the cost of 10 pounds of nails at $4\frac{1}{2}$ cents a pound.
2. What number will contain both 4 and 6?
3. Reduce $\frac{25}{30}$ to lowest terms.
4. One fifth of a number is 2. What is the number?
5. Divide $\frac{4}{5}$ by 2.
6. Subtract $\frac{1}{2}$ from $\frac{3}{5}$.
7. Divide 4 by $\frac{1}{4}$.
8. What is $\frac{1}{4}$ of 4?
9. What is the cost of $\frac{3}{4}$ of a bushel of onions at $2 per bushel?
10. Add $\frac{1}{2}$ and $\frac{1}{4}$.

4

1. Change $\frac{1}{4}$ of a foot to inches.
2. What will $\frac{1}{4}$ of a ton of coal cost at $12 per ton?
3. Divide $\frac{6}{7}$ by 2.
4. Subtract $\frac{2}{3}$ from $\frac{3}{4}$.
5. Divide 6 by $\frac{1}{3}$.
6. What is $\frac{1}{3}$ of 6?
7. Add $\frac{1}{5}$ and $\frac{1}{2}$.
8. One half of a number is 8. What is the number?
9. What will 2 oranges cost at the rate of 42¢ a dozen?
10. Change $5\frac{3}{5}$ to an improper fraction.

5

1. Change $\frac{37}{4}$ to a mixed number.
2. Find the cost of 36 cans of peas at 10¢ a can.
3. Divide 21 by $\frac{1}{2}$.
4. John's sled cost him $5\frac{1}{2}$. He sold it for $4\frac{1}{2}$. How much did he lose?
5. If one third of John's money is seven dollars, how much money has he?
6. Divide $\frac{6}{7}$ by 3.
7. Six is what part of 25?
8. Subtract $\frac{3}{4}$ from $\frac{7}{8}$.
9. Add $\frac{1}{3}$ and $\frac{1}{4}$.
10. What must be paid for $\frac{1}{2}$ a yard of cloth at $3 per yard?

6

1. Subtract $\frac{1}{2}$ from $\frac{2}{3}$.
2. Find the cost of one dozen chairs at $6 each.
3. By what must $\frac{2}{3}$ be multiplied to make 2?
4. What must be added to $\frac{3}{4}$ to make $1\frac{1}{2}$?
5. Divide 21 by $\frac{1}{3}$.
6. Divide 147 by 7.
7. If one fourth of a car of wheat is worth $50, what is the value of the carload of wheat?
8. Divide $\frac{9}{16}$ by 3.
9. Add $\frac{1}{5}$ and $\frac{1}{4}$.
10. Find the cost of $\frac{3}{8}$ of a pound of meat at 40¢ per lb.

7

1. Divide 65 by 12.
2. Subtract $\frac{3}{4}$ from $1\frac{1}{2}$.
3. Reduce 18 to an improper fraction.
4. What is the smallest number that will exactly contain 4 and 6?
5. 15 is what part of 45?
6. Change $1\frac{1}{2}$ bu. to pecks.
7. $\frac{3}{4}$ of a yd. equals how many inches?
8. What will $\frac{3}{4}$ of a yard of ribbon cost at 20¢ a yard?
9. What will 10 magazines cost at $\$\frac{1}{4}$ each?
10. A merchant buys ball-bats for $\$\frac{5}{8}$ each and sells them for $\$\frac{3}{4}$ each. What is his gain?

8

1. $2\frac{1}{4} \times 10 = ?$
2. Find $\frac{3}{4}$ of 60 in.
3. If 2 chairs cost $10, what will 6 chairs cost?
4. Find the cost of $2\frac{1}{2}$ yards of cloth at 40¢ a yard.
5. Add $3\frac{4}{5}$ and $4\frac{1}{5}$.
6. How many quarts are there in $4\frac{1}{2}$ gallons?
7. If 8 quarts of grass seed are required for an acre, how many acres will a bushel seed?
8. Subtract $\frac{3}{8}$ from 3.
9. Reduce $\frac{38}{40}$ to lowest terms.

9

1. Change $\frac{25}{6}$ to a mixed number.
2. At $\$\frac{1}{2}$ each, how many window shades can be bought for $9?
3. $8 \times 2\frac{1}{2} = ?$
4. $8 \times ? = 6.$
5. $3\frac{1}{4} \times 1\frac{1}{4} = ?$
6. $\frac{2}{5}$ of 150 = ?
7. $2\frac{3}{4} + 3\frac{1}{2} = ?$
8. If 12 lb. of rice cost $1.32, what will 6 lb. cost?
9. Twenty-five is $\frac{1}{4}$ of what number?
10. What will 3 oranges cost at 80¢ a dozen?

10

1. At \$8 a ton, what will 1500 tons of coal cost?
2. What will 8 qt. of strawberries cost at 2 quarts for \$.25?
3. Change 90 feet to yards.
4. How many square feet in 11 sq. yd.?
5. A man buys oranges at 50¢ per dozen and sells them at 6¢ each. What is his gain per dozen?
6. Change 66 inches to feet.
7. $44 \div ? = 4$.
8. Subtract $\frac{1}{8}$ from $\frac{1}{3}$.
9. What is $\frac{3}{4}$ of 200?
10. 98 is the sum of 16 and what number?

11

1. How many pounds are there in $\frac{3}{4}$ of a ton?
2. Express 83 in Roman numerals.
3. Change $\frac{27}{5}$ to a mixed number.
4. Change $1\frac{3}{7}$ to an improper fraction.
5. What part of 35 is 7? 6. Find $\frac{1}{8}$ of 360.
7. Change $87\frac{1}{2}$¢ to a fractional part of a dollar.
8. What will 500 lb. of feed cost at \$40 per ton?
9. How many minutes are there in $1\frac{1}{2}$ hours?
10. How many quarts are there in $2\frac{1}{4}$ pecks?

12

1. How many 4 oz. packages of seeds can be made from 2 lb.?
2. Change 45 sq. ft. to square yards.
3. How many square feet are there in a walk 20 ft. long and 3 ft. wide?
4. $3500 \div 100 = ?$
5. 40 square rods is what part of 160 square rods?
6. A merchant gains 15 cents on 10 pounds of sugar. What is his gain on a pound?
7. Find the sum of $4\frac{1}{4}$, $1\frac{1}{4}$, and $\frac{1}{2}$.
8. How many ounces are there in $\frac{7}{8}$ of a pound?
9. At \$12 a rod, what is the cost of 33 feet of fence?
10. Fifteen minutes is what part of an hour?

13

1. From $6\frac{1}{2}$ subtract $4\frac{1}{4}$.
2. What part of 1 sq. ft. are 72 square inches?
3. What fraction of 20 is 4?
4. How many pecks are there in 48 quarts?
5. At 12¢ a quart, how many quarts of milk can be bought for 60¢?
6. How many square feet are there in one third of a square yard?
7. What are the prime factors of 40?
8. Reduce $\frac{14}{35}$ to lowest terms.
9. Add $\frac{2}{3}$ and $\frac{1}{2}$.
10. One factor is 16 and the product is 4. What is the other factor?

14

1. What is the L. C. M. of 6 and 10?
2. Change $\frac{22}{33}$ to lowest terms.
3. What are the prime factors of 44?
4. A man buys goods for $36 and sells them for $42. What is his gain?
5. Add $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$.
6. How many inches are there in $\frac{1}{4}$ of a yard?
7. 96 quarts equal how many bushels?
8. Five pounds equal how many ounces?
9. Nine caps cost $9.90. What is the cost of one cap?
10. $45 \times 5 = ?$

15

1. Divide 560 by 10.
2. Change $3\frac{1}{4}$ to an improper fraction.
3. Write $\frac{1}{2}$ as a decimal.
4. What is the smallest number that will exactly contain 10 and 15?
5. From seven and one fifth take four and one tenth.
6. Add two and three fourths and three and one half.
7. One factor is 15 and the product is 5; what is the other factor?
8. 20 is what fractional part of 100?
9. How many minutes are there in three and one third hours?
10. A man receives $.40 per hour. What will he receive for 8 hours' work?

16

1. At $12\frac{1}{2}$ cents each, how many articles can be bought for \$1?
2. What is two thirds of 66?
3. At \$1.50 each what is the cost of 2 caps?
4. $3\frac{1}{2} + 2\frac{1}{4} + \frac{1}{4} = ?$
5. 15 times ? equals 3.
6. Find the prime factors of 35.
7. Express 54 in Roman numerals.
8. Find the L. C. M. of 5 and 7.
9. How many quarts are there in 2 bushels?
10. What is the cost of 5 dozen eggs at 40¢ a dozen?

17

1. Divide 38 by 6.
2. How many days must a man work at \$4 per day to earn \$48?
3. Four is what fractional part of 32?
4. How many square yards are there in 108 square feet?
5. How many bushels are there in 21 pecks?
6. Add $2\frac{1}{2}$ feet, $7\frac{1}{4}$ feet, $3\frac{1}{4}$ feet.
7. What will be the cost of $2\frac{1}{2}$ dozen apples at 3¢ each?
8. One factor is 80 and the other factor is $\frac{1}{4}$, what is the product?
9. Subtract two and $\frac{3}{8}$ from five and $\frac{7}{10}$.
10. How many 9's are there in 81?

18

1. What is the cost of 2 lb. 8 oz. of meat at 30¢ per pound?
2. How many hours is it from 1 o'clock Monday afternoon to 1 o'clock Tuesday afternoon?
3. At 20 cents each how many cans of corn can be bought for \$2?
4. Which is greater, $\frac{3}{4}$ of a mile or $\frac{7}{8}$ of a mile?
5. From a 3-bushel barrel of apples 2 bu. 3 pk. are sold. How much is left?
6. How many square yards are there in a flat roof 10 yards long by 8 yards wide?
7. Find $\frac{4}{5}$ of 45.
8. What are the prime factors of 44?
9. At 36¢ a pound what will 1 lb. 12 oz. of butter cost?
10. Reduce $\frac{56}{72}$ to lowest terms.

19

1. Find the cost of 1 gal. 2 qt. of oil at 11¢ a pint.
2. What is the perimeter of a rug 9 ft. by 12 ft.?
3. A ham weighs 4 lb. 7 oz. What is it worth at 32¢ a pound?
4. What are 3 eggs worth at 60¢ a dozen?
5. One is what part of three?
6. How many tons of coal at $9 a ton can be bought for $180?
7. Divide 2.5 by 5.
8. How many hours is it from 6:30 A.M. to 11:30 A.M. of the same day?
9. What is $\frac{5}{9}$ of 63?
10. Forty cents is what part of $1?

20

1. $6\frac{1}{4}$ times 20 = ?
2. Change $5\frac{3}{8}$ to an improper fraction.
3. Subtract $4.42 from $5.
4. What will 5 lb. 4 oz. of butter cost at 40¢ a pound?
5. Change 135 min. to hours and minutes.
6. How much must be paid for $2\frac{1}{2}$ bu. of onions at 50¢ a peck?
7. Change 108 sq. ft. to square yards.
8. If corn is worth $3 per hundred, what is the price per ton?
9. At $1.50 per yard, how many yards of cloth can be bought for $9?
10. How many square inches are there in 10 sq. ft.?

21

1. $\frac{1}{2}$ equals how many tenths?
2. $\frac{1}{4}$ equals how many hundredths?
3. 14 oz. is what part of a pound?
4. If 60 pounds of clover seed cost $12, what will 10 pounds cost?
5. What must be paid for 1 lb. 6 oz. of lard at 32¢ per pound?
6. How many square yards of matting are required for a floor 18 ft. by 15 ft.?
7. What is $\frac{5}{9}$ of 81?
8. A merchant buys oats at 60¢ and sells them for 68¢ a bushel. What is his gain on 12 bu.?
9. Change 5 feet 9 inches to inches.
10. 39 plus 7 is how much greater than 39 less 7?

22

1. Write 25 hundredths as a decimal.
2. Find the sum of .3, .6, and .1.
3. Change $\frac{3}{4}$ to 20ths.
4. $\frac{3}{8} + \frac{3}{4} = ?$
5. 20 is what part of 100?
6. $1\frac{5}{6} - 1\frac{1}{4} = ?$
7. What is 1.5×40?
8. $1.2 - .6 = ?$
9. I pay $\frac{3}{8}$ of a dollar for $\frac{1}{2}$ dozen oranges. What do the oranges cost per dozen?
10. How many square rods are there in .5 of 160 square rods?

23

1. Write 35 thousandths.
2. Write 1 and 25 hundredths.
3. How many square feet are there in 1.5 square yards?
4. How many minutes are there in 2.25 hours?
5. From 10 subtract 6 tenths.
6. What part of 2 is $\frac{1}{2}$?
7. A man works from 8 : 30 A.M. to 4 : 30 P.M. with one hour out for noon. How much does he earn at 40¢ per hour?
8. How many ounces are there in $\frac{1}{8}$ of a pound?
9. Subtract .8 from 1.6.
10. 12 is what part of 14?

24

1. Write 19 tenths as a decimal.
2. Write 5 and 56 thousandths.
3. Add .6 and .06.
4. What is the product of $\frac{1}{2}$ and $\frac{1}{4}$?
5. From 4 subtract 2.5.
6. What is the product of .5, 6, and .01?
7. What will 3000 pounds of coal cost at $10 a ton?
8. A car will go 14 miles on 1 gal. of gasoline. How far will it go on 20 gal.?
9. What will 1 lb. 8 oz. of bacon cost at 48¢ a pound?
10. John had $25 and spent $\frac{4}{5}$ of it. How much had he left?

Accomplishment Tests

I — *A*

1. Divide $\frac{1}{2}\frac{8}{3}$ by 6.
2. Divide 21 by $\frac{7}{8}$.
3. Add: 3.55 + 1.73 + .05 + 21.6 + 9.95.
4. Multiply 3.1416 by 400.
5. Divide 9.693 by 3.
6. Change 5 gal. 2 qt. to pints.
7. Change $3\frac{1}{2}$ pecks to quarts.
8. $\frac{35 \times 54}{42 \times 15} = ?$
9. Change 36 square feet to square yards.
10. Change $\frac{5}{8}$ to a decimal.

I — *B*

1. What is the total gain on a 55-ton car of coal at a gain of \$2.85 on a ton?
2. At 45¢ a dozen how many dozen eggs can be bought for \$9?
3. How much must be paid for twelve baseballs if five cost \$3.75?
4. What is gained on a gross of pens bought at \$3.25 and sold at 5 cents each?
5. How much must be paid for 20 gallons of ice cream at 40¢ a quart?

II — *A*

1. $139\frac{1}{5} - 49\frac{3}{4} = ?$
2. $\frac{7}{8}$ times 36 = ?
3. $\frac{2}{3}\frac{1}{2}$ divided by 7 = ?
4. $\frac{1}{2}$ times ? = 30.
5. 1.73 times 49 = ?
6. 942.48 ÷ 300 = ?
7. Change five bushels to quarts.
8. What part of a gallon is three pints?
9. Write $\frac{7}{8}$ as a decimal.
10. Add: 14.333 + 7.25 + 9.375 + 4.57 + 123.5.

II—*B*

1. Find the gain on one dozen chairs which cost $\$6\frac{3}{4}$ each and are sold for \$10 each.

2. What is the cost of 8500 pounds of lime at 30¢ per hundred?

3. Find the average weight of chickens when five weigh $3\frac{1}{4}$, $2\frac{7}{8}$, $3\frac{1}{8}$, $2\frac{3}{4}$, and 3 pounds.

4. Find the cost of $\frac{1}{2}$ dozen cans of peas at $16\frac{2}{3}\text{¢}$ each.

5. Draw a rectangle $4\frac{1}{2}$ inches long and $3\frac{1}{2}$ inches wide.

III—*A*

1. Divide 5 by .025. 2. Multiply $16\frac{2}{3}$ cents by 24.

3. How many square inches are there in a square 11 inches on each side?

4. Multiply 73.694 by 8.3. 5. Subtract .935 from 19.35.

6. Write 6037 in words. 7. Change $\frac{2}{3}$ to 21sts.

8. Change $\frac{37}{8}$ to a mixed number.

9. How many ounces are there in $7\frac{1}{2}$ pounds?

10. Divide 37.89 by .09.

III—*B*

1. Make a billhead for James Post, grocer, Fulton, N. Y., and make a bill for the following articles sold to Frank Lammigan:

$\frac{1}{2}$ dozen oranges at 80 cents a dozen.
2 pounds butter at 38 cents a pound.
$\frac{1}{2}$ bushel potatoes at 30 cents a peck.
2 pounds walnuts at 36 cents a pound.

2. Find the cost of $21\frac{2}{3}$ yards of silk ribbon at 15 cents a yard.

3. What part of \$55 is \$11?

4. Gain $\$37\frac{1}{2}$, selling price \$100. Find the cost.

5. How many square feet are there in a walk 40 feet long and 5 feet wide?

IV—*A*

1. Divide 16.84 by 4000.

2. What part of a square yard is six square feet?

3. What decimal part of 50 is 4?

4. Subtract 1.33 from 50. 5. Divide $6\frac{3}{4}$ by $\frac{3}{8}$.

6. Five eighths of a bushel equals how many quarts?

7. Change $\frac{1}{1\frac{1}{2}}$ of three feet to inches.

8. Write 4397 in words.

9. $\dfrac{63 \times 35 \times 66}{99 \times 49 \times 30} = ?$ 10. $5 \times 1\frac{2}{3} = ?$

IV—*B*

1. What is the effect of moving the decimal point three places to the right?

2. Find the cost of a railroad trip of 138 miles at \$.025 a mile.

3. Write 86,000 pounds as tons.

4. Find the cost of 900 square feet of cement walk at 30¢ a square yard.

5. How many gallons of gasoline at 23 cents a gallon can be bought for \$46.69?

V—A

1. Add: $3\frac{2}{3} + 4\frac{1}{5} + 2\frac{1}{2} + 1\frac{7}{10} + \frac{11}{15}$.
2. Subtract $8\frac{7}{8}$ from $10\frac{1}{4}$.
3. Multiply $14\frac{3}{5}$ by $2\frac{1}{2}$.
4. Divide $5\frac{5}{8}$ by $2\frac{1}{4}$.
5. Multiply 6.735 by 62.4.
6. Divide .985 by 39.4.
7. Subtract .675 from 2.1.
8. Change 40 yards to inches.
9. Change $5\frac{3}{4}$ tons to pounds.
10. What part of a square foot is 36 square inches?

V—B

1. A merchant sells 4 bushels of strawberries at 22¢ a quart. How much does he receive for them?
2. How many minutes are there in five working days averaging five hours each?
3. Oranges costing 67¢ a dozen are sold at three for 25¢. How much is gained on 20 dozen?
4. Find the cost of 4400 pounds of bran at $22 a ton.
5. By what must .035 be multiplied to secure 311.5?

SIXTH GRADE — FIRST HALF

If you are asked how many hands you have, you answer "Two." If you are asked how many days there are in a week, you say "Seven"; or how many cents make a dollar, you say "One hundred." These replies, *two, seven,* and *one hundred,* are numbers.

A **number** is that which tells how many.

Arithmetic is the study of numbers and their applications.

Our word *calculate* comes from the word *calculus,* meaning a *pebble.* It is supposed that in very ancient times men solved simple problems by counting pebbles or by counting their fingers. The use of ten as a basis of our number system is due to the counting of fingers. We call our figures *digits* from the word *digitus* which means *finger.*

When men learned to write, they devised many ways of recording numbers. Most of them were clumsy, and one by one they have disappeared until now we have but two systems in common use, the **Roman,** which uses letters, and the **Arabic,** which uses figures.

Roman Numerals

The chief uses of Roman Numerals are to number chapters in books, to number headings, to express dates on buildings and monuments, and to number the hours on the clock face.

In Roman Numerals, these seven letters are used:

I	V	X	L	C	D	M
1	5	10	50	100	500	1000

1. *Placing a letter after one of the same value or of greater value expresses their sum.* Except IIII on clock dials, no letter is ever repeated more than three times.

III = 1 + 1 + 1 or 3 XV = 10 + 5 or 15

2. *Placing a letter before one of greater value expresses their difference.* Roman numbers written this way are equivalent to Arabic numbers containing either a 4 or a 9. The letters V, L, and D are never written before letters of greater value.

IV = 5 − 1 or 4 IX = 10 − 1 or 9
XIV = 10 + (5 − 1) or 14 XIX = 10 + (10 − 1) or 19

3. *Placing a bar over a letter multiplies its value by* 1000.

$\overline{\text{IV}}$ = 4000 $\overline{\text{X}}$ = 10,000 $\overline{\text{D}}$ = 500,000

The bar over a letter is seldom used.

Supply the numerals:

1.	XI = ?	7.	XL = ?	13.	24 = ?	19.	44 = ?
2.	XIV = ?	8.	L = ?	14.	16 = ?	20.	56 = ?
3.	XV = ?	9.	LXX = ?	15.	36 = ?	21.	79 = ?
4.	IX = ?	10.	XC = ?	16.	19 = ?	22.	95 = ?
5.	IV = ?	11.	CX = ?	17.	13 = ?	23.	226 = ?
6.	XVII = ?	12.	DIX = ?	18.	28 = ?	24.	512 = ?

Arabic Numerals

We are already familiar with the Arabic system of numbers. It had its origin in India and so might properly be called the *Hindoo* system. It was adopted and improved by the Arabs, and for many years it was believed they had invented it, hence its name.

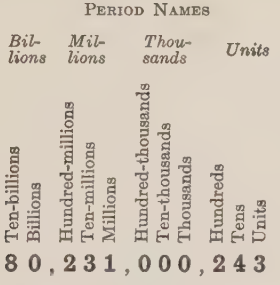
As used by the Hindoos it had nine figures: viz. 1 2 3 4 5 6 7 8 9, called **digits** or **significant figures.** The origin of the 1, 2, and 3 is not known. The other figures are derived from the initials of words meaning "*four, five,*" etc., in an old Hindoo language.

It is not known definitely who added the zero or cipher which is used to show the place in which a digit stands. The word *cipher* comes from an old Arabic word meaning *to be empty.* Before its use numbers had to be written between vertically ruled lines to show which figures expressed tens, which expressed hundreds, etc. The figure 0 is also called *naught,* but present usage, especially in advanced mathematics, favors the Greek name *zero.*

As you have already learned, the value of a figure depends upon its *place* in the number. When standing alone, 8 means *eight.* When followed by one figure, it becomes 80, *eighty;* by two figures, 800, *eight hundred,* etc. Because the value of a digit is increased tenfold every time it is moved *one* place to the left, the Arabic system is called a decimal system. The word *decimal* comes from the Latin *decem* meaning ten.

When a digit is moved one place to the *right,* its value is $\frac{1}{10}$ as great. We may extend the decimal system to the right of units' place and so express fractions. Such fractions are called **decimals.** They are always preceded by a period called the **decimal point** which is written after units' place.

The following shows the grouping of the digits of a number into periods.



This number is read " 80 billion, 231 million, 243."

For convenience in reading and writing large numbers the comma is used to separate a number into periods, or groups of three figures each, counting from the right. The last period at the left may contain one, two, or three figures. A period of 0's is not read. In reading whole numbers avoid saying " and." For example, say " five hundred eighty-seven " — not " five hundred *and* eighty-seven."

Read these numbers:

1. 42,587	7. 17,002	13. 407,593
2. 4,298	8. 40,600	14. 608,639
3. 86,579	9. 99,900	15. 301,301
4. 70,407	10. 10,010	16. 508,003
5. 31,269	11. 183,649	17. 196,005
6. 20,030	12. 242,729	18. 80,010

19.	398,000	**23.**	188,345,768	**27.**	520,360,420
20.	600,000	**24.**	429,503,106	**28.**	200,300,500
21.	3,851,279	**25.**	386,709,308	**29.**	4,296,800,000
22.	76,983,972	**26.**	406,831,211	**30.**	55,300,705,810

Write these numbers in figures :

31. Fifty-one thousand, two hundred sixteen.

32. Seven hundred twenty-one thousand, two hundred.

33. Four million, six hundred eight thousand, three hundred seventy-five.

34. Twenty-five thousand, seven.

35. Twenty-seven million, six hundred fifty.

36. Eighty million, six hundred nine thousand, four hundred twenty-eight.

37. Six hundred twenty million, seventeen thousand.

38. One hundred fifty-seven million, six hundred eight thousand, four hundred seventy-seven.

39. Three billion, fifty-seven million, four hundred seventeen thousand, sixty.

40. Write a number containing three periods.

41. Five hundred four million, forty-six thousand, seven hundred two.

42. Three hundred twenty-four million, two thousand, six hundred forty.

Practice writing numbers from dictation until it can be done rapidly without error.

Write the following in words, inserting a comma after each period name.

43.	30,568	**48.**	205,306	**53.**	12,406,387
44.	52,672	**49.**	423,834	**54.**	154,300,042
45.	30,004	**50.**	400,004	**55.**	1,256,752,316
46.	69,015	**51.**	1,256,105	**56.**	5,063,100,501
47.	21,006	**52.**	3,200,806	**57.**	9,009,009,009

A number that has no fractional part is a **whole number**, or **integer**. A number composed of an integer and a decimal is a **mixed decimal**.

The relation of decimals to integers is shown in the following:

Hundreds	Tens	Units	Decimal point	Tenths	Hundredths	Thousandths	Ten-thousandths	Hundred-thousandths	Millionths
2	5	6	.	3	5	2	6	7	4

This number is read 256 *and* 352,674 *millionths.*

A decimal is read as an integer, and takes the decimal name of its last figure.

.3214 is read 3214 *ten-thousandths.*

.56192 is read 56,192 *hundred-thousandths.*

The word *and* is used in reading mixed numbers and mixed decimals.

25.35 is read 25 *and* 35 *hundredths.*

113.2004 is read 113 *and* 2004 *ten-thousandths.*

Read the following:

1. .5
2. .05
3. .005
4. .7
5. .70
6. .700
7. .035
8. .0101
9. 17.5
10. 16.45
11. .324
12. 5.846
13. 1.7285
14. .001652
15. 38.41658
16. .000053
17. 1065.237
18. 3.141592
19. 17.000008
20. 17.0008
21. .000001
22. .00001
23. .0001
24. .00059
25. .324567
26. 3.24567
27. 32.4567
28. 324.567
29. 3245.67
30. 32456.7
31. 324567.
32. 222.222

Write the following numbers in figures:

33. Five tenths; four tenths; fifteen hundredths.

34. Five hundredths; seven and eight tenths; 8 and 9 tenths.

35. 325 thousandths; 5 thousandths; 19 and 724 thousandths.

36. 7504 hundred-thousandths; 4 hundred-thousandths.

37. Eighteen and 215 ten-thousandths; 5000 ten-thousandths.

38. 400 thousandths; 5 hundred-thousandths; 1 millionth.

39. 112 hundred-thousandths; 15 hundred-thousanths.

40. 324 and 126 millionths; 17 millionths.

41. 1 and 1 tenth; 1 and 1 hundredth; 1 and 1 thousandth.

42. 1 and 1 ten-thousandth; 1 and 1 hundred-thousandth.

43. 1 and 1 millionth; 24 and 3406 ten-millionths.

44. 7846 hundred-millionths; 4 and 15 hundred-thousandths.

45. 75 ten-thousandths; 75 hundred-thousandths; 75 ten-millionths.

46. Three hundred seventy-five thousand and three hundred seventy-five thousandths.

Write in words:

47. 34.35	**50.** 2.006	**53.** 1.6432	**56.** .100
48. 27.003	**51.** 34.05	**54.** 4.0005	**57.** .00001
49. 14.614	**52.** .0051	**55.** 1.0101	**58.** .000001

United States Money

10 mills = 1 cent (ct. or ¢)
10 cents = 1 dime
10 dimes = 1 dollar ($)

The dollar is the unit of United States money. Dimes, cents, and mills are conveniently expressed as *decimals* of a dollar.

$24.30 is read 24 dollars *and* 30 cents.
$.325 is read 32 cents 5 mills.
$.48 or 48¢ is read 48 cents.

Read :

1. $25.34
2. $74.98
3. $25.09
4. $87.15
5. $58.16
6. $17.03
7. $2.843
8. $200.504
9. $192.003
10. $715.38
11. $204.865
12. $384.467
13. $293.062
14. $398.405
15. $294.066

Write in figures, using the $ sign:

16. 16 dollars and 15 cents
17. 19 dollars and 75 cents
18. 61 dollars and 28 cents
19. 25 dollars and 20 cents
20. 200 dollars and 5 cents
21. 28 dollars and 2 cents
22. 1864 dollars and 11 cents
23. 29 dollars and 3 cents
24. 87 dollars and 6 cents 5 mills
25. 13 dollars and 2 cents 5 mills
26. 37 dollars and 42 cents 3 mills
27. 37¢ 3 mills
28. 42¢ 8 mills
29. 75 ct. 3 mills
30. 16 ct. 5 mills
31. 80¢
32. 24¢
33. 14 cents 2 mills
34. 13 cents 5 mills
35. 18 dollars 72 cents
36. 90 dollars 9 cents
37. 2 dollars 2 mills

ADDITION

Finding a number which is equivalent to two or more numbers taken together is **addition.**

The numbers added are **addends.**

The result of addition is the **sum.**

The sign of addition is +. It is read *and* or *plus.*

The sign of equality is =. It is read *equals* or *is equal to.*

Add:

1.	2.	3.	4.	5.	6.	7.
61	28	70	86	81	39	70
68	31	38	37	24	47	39
75	55	65	92	37	69	87
91	72	72	48	63	35	56
42	57	91	36	8	72	28
80	29	86	75	92	84	44
59	32	29	14	54	16	40
32	62	73	35	65	49	51
18	28	84	27	36	50	45

8.	9.	10.	11.	12.	13.	14.
38	81	30	62	72	73	73
46	65	64	26	40	42	51
29	47	45	34	81	68	46
35	63	51	42	27	41	28
28	48	36	47	35	21	71
44	52	72	15	88	47	34
54	37	25	26	97	64	52
33	46	76	54	12	53	43
17	65	26	75	64	51	78
28	31	34	83	23	67	56
24	36	15	91	76	58	44

Adding Decimals

In adding decimals write the numbers so that the decimal points are in a column. Place the decimal point in the sum directly beneath those in the addends.

Add :

1.	13.75	**4.**	22.975	**7.**	99.009	**10.**	46.28
	24.58		13.02		8.17		153.97
	1.005		9.281		29.762		30.003
	26.604		604.22		.625		76.87
	3.2		7.83		82.334		2.099
2.	23.84	**5.**	39.762	**8.**	124.32	**11.**	19.668
	16.21		28.82		41.26		160.95
	7.008		7.635		78.15		281.4
	82.91		92.81		84.099		14.695
	75.75		175.75		375.		854.3
3.	98.842	**6.**	288.65	**9.**	.0089	**12.**	68.49
	8.06		76.28		86.86		295.02
	72.049		32.462		13.788		37.006
	2.8		.009		16.002		8.04
	165.22		3.05		51.69		232.

13. In 1923 the average meat consumption per capita in the United States was: beef 62.5 lb., veal 7.9 lb., mutton and lamb 5.2 lb., pork 91.4 lb. What was the total average consumption of these four kinds of meat?

14. The average family in 1923 consumed beef in the following quantities: 66.1 lb. of steak, 59.9 lb. of roast, 44.7 lb. of stew, and 6.1 lb. of corned beef. How many pounds of beef did such a family use?

15. What is the sum of \$94.68, \$72.95, \$13.25, \$21.50, \$33.00, \$17.24, \$29.77, \$293.08?

Add up, and test your work by adding down :

1.	2.	3.	4.
2673	837	628	18063
846	2964	4307	63259
1025	418	526	28264
92	3825	8279	61287
837	842	428	23428
642	29	4273	43064
4983	561	746	42379

5.	6.	7.	8.	9.
28	639	1050	$1.26	$115.85
39	874	394	1.49	327.15
76	596	769	12.60	495.27
42	421	564	10.04	160.03
89	397	285	9.86	598.09
73	269	784	.24	784.06
97	857	283	208.40	356.24
98	943	275	32.03	35.09
79	268	298	26.07	62.15

Add:

10. Four thousand, thirty ; sixteen thousand, two hundred forty-nine ; ten thousand, four hundred eighty-six ; three hundred ninety-eight thousand, fifty ; eight hundred thousand, seven hundred sixty-nine ; and sixty thousand, seventy.

11. Five million, three hundred eighty-nine thousand, seventy-seven ; ninety million, eight hundred six thousand, seventy-six ; ninety thousand ; three hundred forty-nine million ; and eighty-eight thousand, thirty.

12. Sixteen thousand, twenty-four ; eighteen thousand, four hundred sixty ; seven hundred fifty thousand, two hundred forty-one ; nine hundred seventy-five ; and three hundred forty thousand, two hundred twenty-eight.

SUBTRACTION

Finding how much greater one number is than another is **subtraction.**

The number from which we subtract is the **minuend.**

The number subtracted is the **subtrahend.**

The result of subtraction is the **difference** or **remainder.**

The sign of subtraction is $-$. It is read *less* or *minus.*

1.	$12 - 8 = ?$	**8.**	$23 - 6 = ?$	**15.**	$35 - 7 = ?$
2.	$16 - 9 = ?$	**9.**	$26 - 8 = ?$	**16.**	$42 - 9 = ?$
3.	$15 - 7 = ?$	**10.**	$? + 7 = 24$	**17.**	$75 - 6 = ?$
4.	$8 + ? = 20$	**11.**	$? + 5 = 21$	**18.**	$82 - 4 = ?$
5.	$6 + ? = 11$	**12.**	$4 + ? = 32$	**19.**	$? + 9 = 90$
6.	$? + 9 = 15$	**13.**	$9 + ? = 30$	**20.**	$? + 7 = 61$
7.	$? + 7 = 13$	**14.**	$? + 3 = 32$	**21.**	$8 + ? = 47$

Subtract :

22.	12	**24.**	13	**26.**	16	**28.**	15	**30.**	15	**32.**	11	**34.**	17
	8		4		8		7		9		5		7
23.	24	**25.**	27	**27.**	26	**29.**	21	**31.**	25	**33.**	23	**35.**	22
	6		9		7		3		8		5		4

36. 813 *Minuend*
175 *Subtrahend*
638 *Difference*

Test. — 175 (subtrahend) + 638 (difference) = 813 minuend.

Subtract and test :

37.	375	**39.**	762	**41.**	231	**43.**	411	**45.**	200
	296		285		176		209		131
38.	329	**40.**	513	**42.**	402	**44.**	622	**46.**	295
	175		345		365		273		247

Subtracting Decimals

In subtracting decimals write the numbers so that the decimal points are in a column. Place the decimal point in the difference directly beneath that in the subtrahend. Assume that vacant decimal places at the right of minuend or subtrahend are occupied by zeros.

Subtract and test:

1. 8.42 3.75	6. \$19.20 7.60	11. \$842.50 113.75	16. 187.50 92.23
2. 2.37 1.84	7. \$22.50 7.85	12. \$327.60 148.32	17. 361.12 172.08
3. 8.00 1.62	8. \$35.25 18.55	13. \$428.42 235.75	18. 163.21 128.42
4. 5.03 2.77	9. \$62.40 37.68	14. 22 13.27	19. 723.11 452.26
5. 6.22 2.35	10. \$22.00 17.50	15. \$17.05 3.72	20. 956 765.12

21. Find the difference between one thousand, three hundred twenty-four and thirteen hundredths, and eight hundred ninety-two and seventy-five thousandths.

22. Subtract one thousand, seven hundred twenty-eight from two thousand, one hundred fifty and four tenths.

23. How many years elapsed between 1776 and 1914?

24. From seven and two thousandths subtract five and seventeen hundredths.

25. Subtract thirty-four and twenty-five thousandths from forty-two and six tenths.

Gain or Loss

1. A man sold a farm for $10,250. It cost him $7580. How much was his gain?

The *number* of dollars gained is the difference between 10,250 and 7580.

2. Mr. Jones bought an automobile for $975 and sold it for $460. How much was his loss?

3. Mr. Royce bought a city lot for $2500, and after building a house for $6525, and a garage for $750, he sold it for $12,250. How much did he gain?

4. A merchant had a stock of goods that cost $6650. The stock was damaged by fire. The merchant was obliged to sell the stock for $4280. What was his loss?

5. A merchant in one month sold for $3625 goods that cost him $2332. His expenses for the month were as follows: rent, $150; advertising, $65; light and heat, $100; clerk hire and other expenses, $175.50. How much did he gain or lose for the month?

6. A woman, at a special sale, bought for $3.50 a pair of shoes that were marked $5.00, a remnant of serge worth $9.00 for $4.95, and a blouse marked $3.00 for $.98. How much did she save by waiting for the sale?

7. A boy saw in a store window a sled marked $5.00. He bought lumber for $1.50, nails and screws for 25¢, band steel for 75¢, and paint for 40¢, and made a sled like the one in the window. If his sled was worth $5.00, how much did he earn?

8. Dorothy desired a new coat, but found that a well-made coat of good material would cost $32.50. She waited for an inventory sale and bought a suitable coat for $17.79. How much did she save by waiting?

MULTIPLICATION

Finding a number which is a certain number of times another number is **multiplication.**

The result of multiplication is the **product.**

The numbers multiplied together are the **factors.**

The factor multiplied is the **multiplicand.**

The factor by which we multiply is the **multiplier.**

The sign of multiplication is $\times$. It is read *times* if the factor preceding it is assumed to be the multiplier. It is read *multiplied by* if the factor following it is assumed to be the multiplier.

The product is the same in whatever order the factors are taken.

Find the products:

1. 937×64	**6.** 398×48	**11.** 4964×38
2. 842×29	**7.** 489×35	**12.** 8765×42
3. 649×83	**8.** 359×85	**13.** 9243×99
4. 897×85	**9.** 468×31	**14.** 6835×87
5. 408×96	**10.** 819×19	**15.** 8937×46

16.

429	When we multiply 429 by 567 and 567 by 429, how do the products compare? Multiply 38 by 17 and 17 by 38 and compare the products. Find $2 \times 6 \times 9$. Find $2 \times 9 \times 6$. Find $9 \times 2 \times 6$. Compare the products.	567
567		429
3003		5103
2574		1134
2145		2268
243243		243243

17. Harry has \$35 and James 5 times as much. How much money has James?

18. A square mile contains 640 acres. How many acres are there in 11 sq. miles?

19. What is the cost of 65 sheep at \$9 a head?

1. Multiply 5972 by 689.

5972
689
53748
47776
35832
4114708

In multiplying 5972 by 689 we multiply by 9, by 80, and by 600, and add the results (called partial products). The sum of the partial products is the product required.

We omit the ciphers at the right of the partial products after the first. The second partial product is 477,760. Read the third partial product.

When the multiplier contains a cipher, a partial product is omitted. Why? The next partial product begins two places to the left.

2. 4239×618
3. 368×29
4. 4596×38
5. 6874×63
6. 1024×99
7. 2809×83
8. 7359×83
9. 9138×43
10. 294×137
11. 809×809
12. 799×835
13. 4907×199
14. 2051×7892
15. 345×4006
16. 9999×8507

Estimating Products

Estimating results often prevents absurd mistakes. For example, suppose you are asked to multiply 9275 by 97, you will know, at the outset, that the product should be approximately 900,000; because 97 is almost 100, and 100 times 9000 is 900,000. In the following examples, first estimate the product, then compute it exactly.

17. 8213×96
18. 923×113
19. 4016×52
20. 532×413
21. 982×916
22. 248×99
23. 706×213
24. 199×49
25. 248×439
26. 756×251
27. 297×983
28. 666×492

Multiplying Decimals

Written

1. Multiply 3.456 by 2.47.

$$\begin{array}{r} 3.456 \\ 2.47 \\ \hline 21492 \\ 13824 \\ 6912 \\ \hline 8.53632 \end{array}$$

JUDGMENT TEST. — 3.456 *is less than* **4** and 2.47 *is less than* **3**. The product is therefore *less than* **12**. Also 3.456 is *greater than* **3** and 2.47 is *greater than* **2**; the product is *more than* **6**.

Summary

To multiply decimals, multiply them as integers. Point off in the product as many decimal places as there are decimal places in both factors. If the number of figures in the product is less than the number of decimal places required, prefix zeros.

Estimate each product, then find it exactly by multiplying:

2. 32.5×17	**10.** $.068 \times 5.81$	**18.** $.9756 \times 84$
3. 426×5.9	**11.** $.351 \times .42$	**19.** $.0231 \times .098$
4. 3.08×6.7	**12.** $.4907 \times .018$	**20.** 93.50×78.92
5. 6.015×3.1	**13.** $.029 \times 568$	**21.** $9.10 \times .086$
6. $42{,}805 \times .6$	**14.** $2.879 \times .015$	**22.** $4.375 \times .092$
7. $4.039 \times .24$	**15.** $.030 \times 5960$	**23.** $.999 \times 1000$
8. $.875 \times 1.9$	**16.** $42.691 \times .08$	**24.** $.888 \times 8.88$
9. $13.55 \times .037$	**17.** 30.04×3.400	**25.** 15.15×98.07

Business Problems

1. 25,079 crates of strawberries, each containing 36 quarts, were shipped from the city of Oswego in one season. What were they worth at 8 cents a quart?

2. What is the value of 47 barrels of shredded cocoanut, each containing 105 pounds, at 18 cents a pound?

3. If it costs $4.78 a day to support your family, how much does it cost for a month of 31 days? How much does it cost for a month of 28 days?

4. There are 16 ounces in a pound. One ounce of rolled oats, when cooked, will serve one person. At that rate, how many persons can a restaurant keeper serve with a purchase of 75 pounds of oatmeal?

5. Our school bought a $60 Victrola, 4 records at 75¢ each, two at $1.50, and five at $1.25 each. How much did the school pay for the purchase?

6. Mr. Ford's automobile consumed 496 gallons of gasoline in one year. If a gallon of gasoline was sufficient for 19 miles' travel, how far did the car travel during that year?

7. If a train can run at an average speed of 51 miles an hour, how far can it run in 125 hours?

8. A grocer purchased 1500 eggs at $.45 a dozen. What did the eggs cost him?

9. What is the weight of 1000 barrels of sugar, when the average weight of 1 barrel is 324 pounds?

10. What is the cost of 50 city lots at $675 each?

11. A barrel of flour contains 196 lb. How many pounds are there in 100 barrels of flour?

12. If one acre of land will yield 23 bushels of wheat, how many bushels will 230 acres yield at the same rate?

Short Processes

1. Multiply 834 by 10.

834
10 In multiplying by 10 we annex one zero.
8340

2. Multiply 752 by 100.

In multiplying by 100 we annex two zeros.

3. Multiply 628 by 1000.

In multiplying by 1000 we annex three zeros.

Give products at sight:

4. 864×100	**7.** 375×100	**10.** 341×1000
5. 961×10	**8.** 242×100	**11.** 264×1000
6. 375×10	**9.** 63×100	**12.** 540×1000

13. Multiply 423 by 8000.

423
8000
3,384,000

Multiply :

14. 625 by 600	**19.** 63 by 500	**24.** 8000 by 642
15. 246 by 7000	**20.** 295 by 6000	**25.** 256 by 400
16. 1642 by 900	**21.** 104 by 700	**26.** 600 by 381
17. 1840 by 2000	**22.** 165 by 40	**27.** 795 by 2000
18. 568 by 8000	**23.** 900 by 75	**28.** 1804 by 700

29. Multiply 72.56 by 100.

72.56 In multiplying a decimal by 100 we move
100 the decimal point two places to the right; by
7256 10, one place; by 1000, three places.

Multiply:

30. 86.42 by 100	**32.** 36.29 by 1000	**34.** 7.2693 by 8000
31. 2.684 by 10	**33.** 62.56 by 200	**35.** 3.1416 by 90

Problems

1. John's father earns $10 a day. What is his income for 325 days?

2. East Syracuse is five miles from Syracuse. Utica is ten times as far from Syracuse. How far is Utica from Syracuse?

3. There are 52 weeks in a year. Mary's sister earns ten dollars each week. How much does she earn in a year?

4. Mrs. Shingle bought 100 lb. of sugar at 10¢ a pound. How much did she pay for it?

5. Mr. Brown put in ten tons of coal for the winter. It cost $13.75 a ton. How much did he pay?

6. It takes 30 tons of coal a month to heat the Harris Junior High School. At $13.75 a ton, how much does it cost?

7. Each one of 1000 alumni contributed $375 to a University Drive. How much did they contribute?

8. Billy's father bought 100 rugs at $83.50 each. What was his bill?

9. Potatoes sold at $.48 a bushel. Mr. Gorman bought 400 bushels. What amount did he pay?

10. In the First Trust and Deposit Company there were 600 accounts averaging $92.18 each. What was the total amount of these accounts?

11. What will 265 dozen eggs cost at $.68 a dozen?

12. Find the cost of 18 tons of coal at $13.25 a ton.

13. A mile is 63,360 inches. How many inches are there in .625 mi.?

14. A mile is 5280 feet. How many feet are there in 8.75 miles?

DIVISION

Finding one of two factors when the other factor and the product are given is **division.**

In division, the product is called the **dividend,** the given factor the **divisor,** and the factor to be found the **quotient.**

When the divisor is not exactly contained in the dividend, the *part of the dividend that is left* is called the **remainder.**

E.g. 59 ÷ 8 = 7 *quotient,* and 3 *remainder.*

When there is no remainder, the division is said to be *exact.*

The sign of division is ÷. It is read *divided by,* and is always preceded by the dividend and followed by the divisor.

Sometimes the line is omitted from the division sign. It still has the same meaning but is called the **sign of ratio** (:).

Forty-eight divided by 4 may be indicated 48 ÷ 4, or $4\overline{)48}$, or $\frac{48}{4}$, or $\frac{1}{4}$ of 48.

Give the quotients:

1. 54 ÷ 6	9. $3\overline{)27}$	17. $\frac{144}{12}$	25. $\frac{1}{10}$ of 120
2. 48 ÷ 8	10. $4\overline{)36}$	18. $\frac{80}{10}$	26. $\frac{1}{5}$ of 85
3. 36 ÷ 9	11. $7\overline{)28}$	19. $\frac{66}{11}$	27. $\frac{1}{8}$ of 96
4. 72 ÷ 8	12. $5\overline{)35}$	20. $\frac{110}{11}$	28. $\frac{1}{12}$ of 132
5. 63 ÷ 7	13. $9\overline{)45}$	21. $\frac{96}{8}$	29. $\frac{1}{2}$ of 64
6. 77 ÷ 11	14. $7\overline{)56}$	22. $\frac{121}{11}$	30. $\frac{1}{7}$ of 35
7. 72 ÷ 9	15. $10\overline{)70}$	23. $\frac{42}{6}$	31. $\frac{1}{9}$ of 63
8. 56 ÷ 7	16. $4\overline{)32}$	24. $\frac{21}{7}$	32. $\frac{1}{11}$ of 77

Principles of Division

$$32 \div 8 = 4$$

Let us observe how the value of the quotient 4 is affected as we change the value of the dividend 32 and of the divisor 8.

1. $32 \div 8 = 4$
$\mathbf{64} \div 8 = 8 \quad (2 \times 4)$ Multiplying the dividend by 2 multiplies the quotient by 2.

$32 \div 8 = 4$
$32 \div \mathbf{4} = 8 \quad (2 \times 4)$ Dividing the divisor by 2 multiplies the quotient by 2.

2. $32 \div 8 = 4$
$\mathbf{16} \div 8 = 2 \quad (4 \div 2)$ Dividing the dividend by 2 divides the quotient by 2.

$32 \div 8 = 4$
$32 \div \mathbf{16} = 2 \quad (4 \div 2)$ Multiplying the divisor by 2 divides the quotient by 2.

3. $32 \div 8 = 4$
$\mathbf{64} \div \mathbf{16} = 4$ Multiplying or dividing both 32 and 8 by 2 does not change the quotient.
$32 \div 8 = 4$
$\mathbf{16} \div \mathbf{4} = 4$ Try this many times, using different numbers and observe results.

Principles

1. *Multiplying the dividend, or dividing the divisor, by any number multiplies the quotient by that number.*

2. *Dividing the dividend, or multiplying the divisor, by any number divides the quotient by that number.*

3. *Multiplying or dividing both dividend and divisor by the same number does not change the quotient.*

State the principle illustrated:

1. $96 \div 12 = 8$
$96 \div 24 = 4$

2. $96 \div 12 = 8$
$96 \div 6 = 16$

3. $96 \div 12 = 8$
$48 \div 6 = 8$

4. Illustrate the remaining principles.

Long Division

1.

```
      829   Quotient
41)33989
   328
    118
     82
     369
     369
```

2.

```
      208   Quotient
49)10192
    98
     392
     392
```

In example 2, after 9 of the dividend was brought down, 39 would not contain 49, and 0 was written in the quotient. Then 2 was brought down.

Memorize these steps in long division :

I. **Divide**	IV. **Subtract**
II. **Write quotient figure**	V. **Bring down**
III. **Multiply**	VI. **Repeat**

Find the quotients, and test your work :

3. 20,213 ÷ 41	**15.** 112,035 ÷ 231	**27.** $33,825 ÷ 41
4. 34,578 ÷ 51	**16.** 635,173 ÷ 791	**28.** $6566 ÷ 67
5. 51,832 ÷ 62	**17.** 98,230 ÷ 235	**29.** $9184 ÷ 82
6. 9372 ÷ 33	**18.** 135,248 ÷ 316	**30.** $7396 ÷ 86
7. 38,364 ÷ 92	**19.** 348,552 ÷ 423	**31.** $3335 ÷ 23
8. 13,950 ÷ 75	**20.** 635,976 ÷ 803	**32.** $3222 ÷ 18
9. 35,240 ÷ 99	**21.** 110,889 ÷ 999	**33.** $10,279 ÷ 19
10. 55,232 ÷ 64	**22.** 272,688 ÷ 437	**34.** $18,531 ÷ 213
11. 11,043 ÷ 27	**23.** 272,688 ÷ 624	**35.** $7344 ÷ 24
12. 22,770 ÷ 45	**24.** 580,110 ÷ 634	**36.** $5390 ÷ 14
13. 33,235 ÷ 85	**25.** 81,263 ÷ 247	**37.** $5019 ÷ 21
14. 26,796 ÷ 58	**26.** 94,605 ÷ 901	**38.** $28,980 ÷ 36

Division of Decimals

1. Divide 27.3587 by 4.7.

```
      5.821          Test
47)273.587          5.821
   235                 4.7
    385               40747
    376              23284
     98             27.3587
     94
      47
      47
```

For convenience and accuracy in placing the decimal point, make the divisor an integer and move the decimal point in the dividend as many places to the right as there were decimal places in the divisor. The decimal point in the quotient will then be directly above the decimal point in the dividend.

When the given dividend contains fewer decimal places than the divisor, annex zeros to the dividend to make the required number of decimal places.

Divide and test:

2. 27.72 by 3.85
3. 5074.65 by 56.7
4. 10.5252 by 2.94
5. 6.79592 by .76
6. 111.34 by 293
7. 16.35 by .025
8. 205.3758 by 64.2
9. 102.6 by .27
10. 340.2 by .042
11. 34,177 by 14.3
12. 190.0892 by 20.3
13. 8.19 by 195
14. 35.434 by .014
15. 8674.975 by .025
16. 397 by .125
17. 273.273 by 63.7

1. How many bushels are there in 24,064 quarts? There are 32 quarts in a bushel.

2. If a train runs 54 miles an hour, in how many hours will it run 243 miles?

3. A guide has enough coffee to last one person 360 days. How long will it last 16 persons?

4. A square foot contains 144 square inches. How many square feet are there in 1836 square inches?

5. How much must I pay for one yard of broadcloth, when 6.75 yd. cost $\$10.12\frac{1}{2}$?

6. A wheat bin contains 32,256.3 cubic inches, and holds 15 bushels. How many cubic inches are there in a bushel?

7. A cubic foot of water contains 1728 cubic inches, and a gallon measure contains 231 cubic inches. How many gallons are there in a cubic foot of water ?

8. A woman pays $2.10 for butter at 42¢ a pound. How many pounds does she buy?

9. A field of 31 acres produces 2642.75 bushels of potatoes. What is the yield per acre?

10. A train runs 531 miles in 12.5 hours. What is the rate per hour?

11. A builder bought 6.6 thousand bricks for $82.50. What was the price per thousand?

12. There are 984.25 inches in twenty-five meters. How many inches are there in 1 meter?

13. The product of two factors is 197.1864. One of the factors is 6.12. What is the other factor?

14. There are 5280 ft. in a mile and 3 ft. in a yard. How many yards are there in a mile?

1. Divide 4.325 by .5.

$$5\overline{)43.25}\quad 8.65$$

When a decimal point occurs in the divisor, consider that the decimal point is moved as many places to the right, in both divisor and dividend, as there are decimal places in the divisor. Place the decimal point in the quotient directly above the decimal point in the dividend. Test by multiplying the quotient by the divisor to obtain the original dividend.

Divide:

2. 3.6942 by .2 **4.** 54.36 by .9 **6.** 35.922 by .03

3. 46.35 by .5 **5.** 5.436 by .09 **7.** 27.438 by.06

8. 33.74 by .4

$$4\overline{)337.40}\quad 84.35$$

After dividing, if there is a remainder, annex as many zeros to the dividend as may be needed, and continue the division.

9. 2.061 by .5 **11.** .1875 by .06 **13.** .3 by .4

10. .2142 by .06 **12.** .0249 by .4 **14.** 3.5 ÷ .8

15. .0475 by .8

$$8\overline{)0.475}\quad .059$$

It is seldom necessary to carry the quotient more than two decimal places. If there is still a remainder, a + (plus) is placed after the last quotient figure.

16. 10. by .03 **18.** .321 by .7 **20.** 1 by .7

17. 1.23 by .7 **19.** .018103 by 6 **21.** 2 by .3

To divide by 10, 100, 1000, *etc., remove the decimal point to the left as many places as there are zeros in the divisor.*

Divide by 10; *by* 100; *and by* 1000:

22. 386.4 **24.** 558. **26.** 39.1 **28.** 111

23. 168.43 **25.** .5 **27.** 115.5 **29.** .1

1. At \$5 a barrel how many barrels of apples can be bought for \$2535?

The *number* of barrels is the quotient of $2535 \div 5$.

2. When 6 tons of coal cost \$51, what is the cost per ton?

The *number* of dollars 1 ton will cost is the quotient of $51 \div 6$.

3. If \$96.64 is divided equally among 8 men, how much does each man receive?

4. If a train runs 338.88 miles in 8 hours, what is the average per hour?

5. A dealer bought 8 head of cattle for \$283.60. What was the average cost per head?

6. An estate of \$39,848 was left to several children. A received $\frac{1}{4}$ of it, and B $\frac{1}{5}$ of it. What was A's share? B's share?

7. A man earns \$1800 a year, and his son earns $\frac{1}{6}$ as much. How much does his son earn?

8. The product of two factors is 9.765. One of them is .9. What is the other?

9. The dividend is 7.9. The divisor is .7. Find the quotient *to the nearest hundredth.*

$7.9 \div .7 = 11.285$. The 5 thousandths being half of a hundredth, is called another hundredth, and the quotient is 11.29.

10. Divide 1.561 by 5 to the nearest hundredth.

11. Divide 2 by .6 to the nearest thousandth.

Annex decimal zeros to the dividend, and divide.

12. Divide 4 by 6 to the nearest hundredth.

13. Divide 10 by 7 to the nearest hundredth.

14. Divide 2.1446 by 5 to the nearest hundredth.

15. A field of 8 acres yielded 228.8 bushels of wheat. How much was the yield per acre?

FACTORS AND PRODUCT

Two factors given to find the product. How is it found?

When one factor is less than 1, the product is less than the other factor.

When one factor is greater than 1, the product is greater than the other factor. The word *of*, following a fraction or a decimal, means "*times.*"

Estimate answers, then multiply, and test by division:

1. .24 × 60 = ?
2. .125 × 80 = ?
3. .98 × 200 = ?
4. .15 of 50 = ?
5. 1.05 × $675 = ?
6. .04 × 1542.36 = ?
7. .06 of $88.60 = ?
8. .25 of $12.40 = ?

Make a statement like the one above, estimate, and solve:

9. James had $50 in the bank, and drew out .8 of it. How much did he draw out?

By estimating, we find that the result will be less than $50 because the factor .8 is less than 1.

Statement: He drew out .8 of $50. .8 × $50 = (?) Two factors, to find a product.

10. Mr. A's farm was worth $10,000. What was .25 of it worth?

11. An excavation of 460 cubic yards was .75 completed. How many cubic yards were excavated?

12. A shipper lost .10 of a shipment of eggs by freezing. He shipped 250 dozen eggs. How many dozen were lost?

13. A young man received .40 of an estate worth $12,000. How much did he receive?

14. How much is .125 of 800?

A product and a factor given to find the other factor. How is it found?

When the divisor is less than 1, the quotient is greater than the dividend.

When the divisor is greater than 1, the quotient is less than the dividend.

1. $.06 \times ? = \$84$
   $\$84 \div .06 = ?$

Estimate, then divide, and test by multiplication:

2. $240 \div .25 = (?)$
3. $308.40 \div .05 = (?)$
4. $\$900 \div .75 = (?)$
5. $210 \div 1.05 = (?)$
6. $.05$ of $(?) = 65$
7. $.25$ of $(?) = \$400$
8. $.5$ of $(?) = 60$ men
9. $.375$ of $(?) = 96$ ounces
10. $.50$ of $(?) = 15$
11. $.90$ of $(?) = 81$

Make a statement, estimate, and solve:

12. Elizabeth has earned \$15, which is .75 of her money in the bank. How much has she in the bank?

Statement: .75 of her money in the bank is \$15. .75 of (?) = \$15. What is given? What is to be found?

13. An agent sold his motor car for \$750, which was .80 of what it cost him. How much did it cost him?

14. If .5 of my money is \$350, how much money have I?

15. A man pays \$300 rent, which is .15 of his salary. How much is his salary?

16. A man loses \$200 on cotton. This is .05 of what the cotton cost. What did it cost?

A product and a factor given to find the other factor.

When one factor is greater than the product, the other factor is less than 1.

When one factor is less than the product, the other factor is greater than 1.

Estimate, then divide, and test by multiplication:

1. $15 \div 45 = (?)$ $45\overline{)15.00}$ Annex decimal zeros to the dividend and divide.

a. What part of 24 is 18?

b. 18 is what part of 24?

c. What part of 24 = 18?

d. $? \times 24 = 18$.

Above are four ways of asking the same question.

2. ? (part) of 24 = 18
3. ? (part) of 12 = 8
4. ? (part) of \$24 = \$6
5. ? of 200 = 12
6. $? \times 150 = 90$
7. $? \times 60 = 45$
8. $? \times \$160 = \$20$
9. $? \times 80$ men = 60 men
10. (? part) of 80 = 50
11. (? part) of 16 = 4

Make statements like the above, estimate, and solve:

12. John had 48 chickens. 12 of them were Plymouth Rocks. What part of them were Plymouth Rocks?

STATEMENT: What part of 48 is 12? $(?) \times 48 = 12$. Product and one factor given to find the other factor.

13. In a school of 900 pupils, 450 were girls. What decimal part of them were girls?

14. Robert earned 80¢ and used 50¢ to buy war stamps. What part of his money was spent for stamps?

15. Lucy missed 5 words in spelling 20 words. What part of the words did she miss?

Problems

1. Thomas spelled correctly .94 of 50 words. How many words were spelled correctly?

2. A man gave his son 125 acres of land. This was .25 of his farm. How many acres were there in the farm?

3. Mrs. Allen sold her auto for $500 and gave $375 to the Red Cross. What part of the money did she give?

4. If .75 of my income is $1650, how much is my income?

5. If my income is $2500 and I use $500 to pay rent, what part of my income do I use for rent?

6. A football player ran .8 of the length of the field. If he ran 80 yd., how long was the field?

7. If .5 of an acre of land costs $72, what is the cost of an acre?

8. A farmer who owned 240 acres of land, sold .25 of it. How many acres did he sell?

9. A grocer had 480 lb. of A sugar and sold .125 of it. How many pounds did he sell?

10. What part of a bushel (32 quarts) is 24 quarts?

11. If there are 40 pupils in a class and 36 of them are promoted, what part of them are promoted?

12. Our baseball team was defeated only 3 times. It lost .2 of the games played. How many games were played?

13. How many pounds are there in .125 of a ton (2000 lb.)?

14. Nine inches are what part of a foot?

15. A man sold 160 cattle, which was .80 of his herd. How many cattle were there in the herd?

16. Henry's college expenses are $719 a year. .04 of this is spent for books. What is the cost of Henry's books?

Divisibility of Integers

An integer which divides a number without a remainder is an **exact divisor** of that number.

2, 4, 5, and 10 are exact divisors of 20. *Divisible* is understood to mean *exactly divisible.*

Factors may be either *integral* or *fractional.* The term *factor* is generally used to mean *integral factor.*

An **exact divisor** of a number is also an **integral factor of that number.**

A **prime number** is an integer that has no factor except itself and 1.

A **composite number** is an integer that has factors other than itself and 1.

Name the prime numbers from 1 to 25.

An integer that is divisible by 2 is an **even number.**

An integer that is not divisible by 2 is an **odd number.**

A number is divisible

1. By **2** if its right-hand figure is 0, 2, 4, 6, or 8.

2. By **4** if the *two* right-hand figures are zeros or if the number expressed by them is divisible by 4.

3. By **8** if the *three* right-hand figures are zeros or if the number expressed by them is divisible by 8.

4. By **5** if the last figure is 0 or 5.

5. By **10** if the last figure is 0.

6. By **3** if the sum of its digits is divisible by 3.

7. By **9** if the sum of its digits is divisible by 9.

8. By **6** if it is divisible by both 2 and 3.

9. By **12** if it is divisible by both 3 and 4.

10. By **15** if it is divisible by both 3 and 5.

11. By **20** if the unit figure is 0 and the tens figure is even.

12. By **25** if the last *two* figures are 00, 25, 50, or 75.

Which of the following numbers are divisible

1. By 2?	**4.** By 3?	**7.** By 5?	**10.** By 12?
2. By 4?	**5.** By 6?	**8.** By 10?	**11.** By 15?
3. By 8?	**6.** By 9?	**9.** By 25?	**12.** By 20?

a. 9312	*e.* 91,000	*i.* 32,345
b. 6741	*f.* 326,104	*j.* 128,394
c. 91,280	*g.* 819,225	*k.* 823,125
d. 247,895	*h.* 1,683,747	*l.* 637,920

Prime Numbers

What is a prime number?

A factor that is a prime number is a **prime factor.**

5 and 3 are prime factors of 30.

Numbers that have no common factor except 1 are **prime to each other.** 8 and 27 are *prime to each other.*

1. Separate 231 into its prime factors.

$$\begin{array}{r|l} 3 & 231 \\ 7 & 77 \\ \hline & 11 \end{array}$$

Test the number to see if it is divisible by the *prime numbers* 2, 3, 5, 7, etc.

$231 = 3 \times 7 \times 11.$

Divide by a prime number; then divide the quotient by a prime number and continue until the quotient is prime. The divisors and the last quotient are the prime factors.

Find the prime factors of :

2. 63	**6.** 636	**10.** 2800	**14.** 3465
3. 84	**7.** 720	**11.** 1155	**15.** 13,104
4. 250	**8.** 1572	**12.** 2310	**16.** 11,550
5. 210	**9.** 1872	**13.** 3150	**17.** 17,325

Cancellation

Striking out the same factor from both dividend and divisor is **cancellation.**

The solution of problems involving division can often be shortened by cancellation.

To solve such problems: 1. *analyze the problem,* 2. *make the statement,* 3. *cancel and solve.*

1. If 15 bushels of potatoes cost \$11.25, what should 21 bushels be worth?

Statement: $\frac{21 \times \$11.25}{15} = ?$

2. When 18 oranges cost 72¢, what will 6 oranges cost?

Find results by cancellation:

3. $\frac{35 \times 64 \times 77}{42 \times 12}$ **4.** $\frac{58 \times 39 \times 75}{87 \times 26 \times 15}$

5. When 60 yd. of cloth cost \$120, how many yards can be bought for \$40?

6. When 15 hats cost \$45, how much will 7 hats cost?

7. In how many days can a young man, at \$2 a day, earn as much as his father can earn in 40 days at \$3 a day?

8. What is the cost of 192 quarts of chestnuts when 32 quarts cost \$2.50?

Greatest Common Divisor

Optional

An integer that will exactly divide each of two or more numbers is their **common divisor.** The largest integer that will divide each of two or more numbers is their **greatest common divisor,** G. C. D.

The G. C. D. may often be found by **inspection.**

See if the smallest of the given numbers will exactly divide each of the others. If it will, it is the G. C. D. If it will not, try $\frac{1}{2}$ of it, then $\frac{1}{3}$ of it, then $\frac{1}{4}$ of it, and so on until a number is found that will divide each of the others.

1. What is the G. C. D. of 24, 36 and 64?

We first try 24. It will not divide 36 or 64.
Try $\frac{1}{2}$ of 24 or 12. It will not divide 64.
Try $\frac{1}{3}$ of 24 or 8. It will not divide 36.
Try $\frac{1}{4}$ of 24 or 6. It will not divide 64.
Try $\frac{1}{6}$ of 24 or 4. It will divide 36 and 64. 4 is the G. C. D.

What is the G. C. D. of:

2. 6 and 9	**7.** 15 and 20	**12.** 9, 12, and 15
3. 9 and 12	**8.** 12 and 36	**13.** 15, 20, and 25
4. 8 and 12	**9.** 16 and 24	**14.** 14, 21, and 28
5. 6 and 10	**10.** 9 and 15	**15.** 12, 18, and 24
6. 12 and 15	**11.** 15 and 21	**16.** 24, 32, and 40

The G. C. D. may be found from the **prime factors.**

Separate each number into its prime factors.

Take each prime factor the number of times it occurs in *every* given number and the product is the G. C. D. If no number is found that is a factor of all the given numbers the G. C. D. is 1.

17. Find the G. C. D. of 24, 36, and 64.

$24 = 2 \times 2 \times 2 \times 3$ 2 occurs twice in each number.
$36 = 2 \times 2 \times 3 \times 3$ 3 occurs only in 24 and 36.
$64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$ $2 \times 2 = 4$, G. C. D.

Find the G. C. D. of:

18. 42 and 63
19. 84 and 132
20. 90 and 105
21. 112 and 168
22. 90 and 150
23. 40, 60, and 80
24. 64, 144, and 560
25. 36, 48, and 24
26. 40, 56, and 72
27. 18, 54, and 32
28. 45, 60, and 90
29. 36, 72, and 81
30. 44, 121, and 132
31. 63, 126, and 189

Least Common Multiple

A number that will exactly contain another is a **multiple** of that number. 12 is a multiple of 4.

A number that will exactly contain each of two or more numbers is their **common multiple.** Both 12 and 24 are common multiples of 2, 3, 4, and 6.

The smallest number that will exactly contain each of two or more numbers is their **least common multiple,** L.C.M. 12 is the L. C. M. of 2, 3, 4, and 6.

The L. C. M. may often be found by **inspection.**

See if the largest of the given numbers will contain each of the others. If it will, it is the L. C. M. If it will not, multiply it by 2, then by 3, then by 4, and so on until a number is found that will contain each of the others.

1. What is the L. C. M. of 8, 12, and 20?

We first try 20.	It will not contain either 8 or 12.
Then try 2×20 or 40.	It will not contain 12.
Try 3×20 or 60.	It will not contain 8.
Try 4×20 or 80.	It will not contain 12.
Try 5×20 or 100.	It will not contain either 8 or 12.
Try 6×20 or 120.	It contains both 8 and 12.

120 is the L. C. M.

What is the L. C. M. of:

2. 6 and 8	**6.** 4, 6, and 8	**10.** 6, 18, and 27
3. 4 and 8	**7.** 4, 6, and 9	**11.** 9, 12, and 18
4. 6 and 9	**8.** 2, 6, and 12	**12.** 7, 9, and 12
5. 6 and 10	**9.** 4, 8, and 12	**13.** 8, 24, and 30

The L. C. M. of two or more numbers may be found from their **prime factors.**

Separate each number into its prime factors. Take each prime factor the greatest number of times it occurs in *any one* of the given numbers. The product of the factors thus selected is the L. C. M.

14. What is the L. C. M. of 8, 12, and 20?

$8 = 2 \times 2 \times 2$ — 2 occurs *3 times*, as a factor, in 8.
$12 = 2 \times 2 \times 3$ — 3 occurs once, as a factor, in 12.
$20 = 2 \times 2 \times 5$ — 5 occurs once, as a factor, in 20.
$2 \times 2 \times 2 \times 3 \times 5 = 120$, L. C. M.

Find the L. C. M. of:

15. 18, 27, and 30	**26.** 45, 70, and 90
16. 9, 12, and 18	**27.** 16, 24, and 36
17. 16, 48, and 60	**28.** 18, 32, and 48
18. 21, 27, and 36	**29.** 15, 30, 21, and 28
19. 36, 40, and 48	**30.** 25, 20, 35, and 40
20. 18, 24, and 36	**31.** 14, 21, 35, and 45
21. 15, 20, and 31	**32.** 24, 48, 96, and 192
22. 45, 36, and 70	**33.** 24, 42, 54, and 360
23. 36, 40, and 42	**34.** 45, 36, 70, and 90
24. 42, 54, and 96	**35.** 36, 40, 42, and 48
25. 40, 42, and 48	**36.** 24, 36, 60, and 90

NOTE. — The L. C. M. of large numbers that are not easily factored may be found as follows: Find the G. C. D. of the given numbers. Divide each of the numbers by the G. C. D., and find the L. C. M. of the quotients. Multiply this L. C. M. by the G. C. D. and the result is the L. C. M. sought.

FRACTIONS

A **fraction** is a part of a unit.

The chief use of fractions is to express values less than 1. Such fractions are called **proper fractions**, *e.g.* $\frac{2}{3}$, $\frac{3}{5}$. If a fraction expresses a value of 1 or more than 1 it is an **improper fraction**, *e.g.* $\frac{7}{7}$, $\frac{5}{2}$.

A common fraction has two **terms**, a numerator and a denominator. The **numerator** is always a *dividend* and the **denominator** is always a *divisor*. The value expressed by the fraction is the quotient of its numerator divided by its denominator. A fraction whose denominator is 10, 100, 1000, etc. is a **decimal** fraction, *e.g.* 3. $\frac{3}{10}$, $\frac{5}{100}$. A decimal fraction whose denominator is indicated by the number of places at the right of a decimal point is a **decimal**, *e.g.* 5.75.

The word "*fraction*" is usually understood to mean "*common fraction.*"

A number composed of an integer and a fraction is a **mixed number**, *e.g.* $5\frac{7}{8}$, $37\frac{1}{2}$.

Principles of Fractions

From the principles of division on page 169 we may formulate the following principles of fractions:

Prin. 1. *Multiplying the numerator or dividing the denominator by any number multiplies the value of the fraction by the same number.*

Prin. 2. *Dividing the numerator or multiplying the denominator of a fraction by any number divides the value of the fraction by the same number.*

Prin. 3. *Multiplying or dividing both terms of a fraction by the same number does not change the value of the fraction.*

Reduction to Higher or Lower Terms

1. In one apple there are how many halves of an apple? How many fourths of an apple?

2. In $\frac{1}{2}$ of an apple there are how many fourths of an apple? How many sixths?

3. How many eighths of an apple are there in $\frac{3}{4}$ of an apple?

4. In $\frac{1}{3}$ there are how many sixths of an apple?

5. In $\frac{2}{3}$ there are how many sixths?

6. Name a fraction equal to $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$.

Change

7. $\frac{2}{4}$ to halves
8. $\frac{2}{6}$ to thirds
9. $\frac{1}{2}$ to fourths
10. $\frac{1}{2}$ to eighths
11. $\frac{1}{3}$ to sixths
12. $\frac{1}{3}$ to ninths

13. In changing $\frac{6}{8}$ to *larger* terms, what operation do you perform?

14. In changing $\frac{6}{8}$ to *smaller* terms, what operation do we perform?

Changing the form of a number without changing its value is **reduction.**

15. Reduce $\frac{3}{4}$ to sixteenths.

$\frac{3}{4} = \frac{12}{16}$

The new denominator, 16, is 4 times the given denominator 4. In accordance with principle 3 we multiply both numerator and denominator by 4, which gives $\frac{12}{16}$.

Reduce :

16. $\frac{3}{5}$ to 10ths
17. $\frac{2}{3}$ to 9ths
18. $\frac{1}{2}$ to 20ths
19. $\frac{5}{6}$ to 18ths
20. $\frac{3}{9}$ to 18ths
21. $\frac{7}{8}$ to 24ths
22. $\frac{1}{6}$ to 24ths
23. $\frac{3}{7}$ to 21sts
24. $\frac{4}{5}$ to 25ths
25. $\frac{3}{7}$ to 21sts
26. $\frac{11}{12}$ to 24ths
27. $\frac{3}{8}$ to 24ths

Reduce:

1. $\frac{17}{24}$ to 96ths
2. $\frac{7}{8}$ to 64ths
3. $\frac{9}{25}$ to 75ths
4. $\frac{16}{40}$ to 120ths
5. $\frac{13}{70}$ to 140ths
6. $\frac{23}{75}$ to 150ths
7. $\frac{19}{36}$ to 144ths
8. $\frac{11}{16}$ to 128ths
9. $\frac{21}{25}$ to 100ths
10. $\frac{47}{56}$ to 112ths
11. $\frac{17}{18}$ to 72ds
12. $\frac{5}{8}$ to 800ths

When the terms of a fraction are prime to each other, the fraction is in its **lowest terms.**

A proper fraction in its lowest terms is said to be in its **simplest form.**

13. Reduce $\frac{12}{16}$ to lowest terms.

$\frac{12}{16} = \frac{3}{4}$

Principle **3** permits us to divide both numerator and denominator by 4, which gives us $\frac{3}{4}$.

Reduce to lowest terms :

14. $\frac{3}{6}$
15. $\frac{10}{12}$
16. $\frac{4}{8}$
17. $\frac{5}{10}$
18. $\frac{15}{18}$
19. $\frac{20}{30}$
20. $\frac{16}{20}$
21. $\frac{16}{24}$
22. $\frac{15}{21}$
23. $\frac{14}{28}$
24. $\frac{18}{36}$
25. $\frac{9}{15}$
26. $\frac{15}{36}$
27. $\frac{18}{24}$
28. $\frac{12}{48}$
29. $\frac{15}{60}$
30. $\frac{22}{36}$
31. $\frac{24}{27}$

22. Reduce $\frac{30}{45}$ to lowest terms.

$\frac{30}{45} = \frac{6}{9} = \frac{2}{3}$

Dividing both terms of $\frac{30}{45}$ by 5, we have $\frac{6}{9}$.

Dividing both terms of $\frac{6}{9}$ by 3, we have $\frac{2}{3}$. Since 2 and 3 are prime to each other, $\frac{2}{3}$ is the answer required.

If a fraction cannot easily be reduced to its lowest terms, divide both terms by their G. C. D.

Reduce to lowest terms:

32. $\frac{36}{54}$
33. $\frac{72}{108}$
34. $\frac{27}{81}$
35. $\frac{45}{95}$
36. $\frac{38}{86}$
37. $\frac{55}{99}$
38. $\frac{60}{360}$
39. $\frac{72}{148}$
40. $\frac{214}{316}$
41. $\frac{75}{225}$
42. $\frac{80}{236}$
43. $\frac{124}{224}$
44. $\frac{270}{315}$
45. $\frac{21}{54}$
46. $\frac{77}{165}$
47. $\frac{12}{14}$
48. $\frac{30}{45}$
49. $\frac{9}{24}$
50. $\frac{72}{192}$
51. $\frac{105}{189}$
52. $\frac{42}{130}$
53. $\frac{135}{405}$
54. $\frac{140}{420}$
55. $\frac{104}{136}$
56. $\frac{96}{264}$

Reduction of Integers and Mixed Numbers to Improper Fractions

1. How many thirds are there in 4?

$1 = \frac{3}{3}$; $4 = \frac{3}{3} + \frac{3}{3} + \frac{3}{3} + \frac{3}{3} = \frac{12}{3}$,
or 4×3 *thirds* $= 12$ *thirds*.

2. Reduce $5\frac{1}{5}$ to fifths.

First change 5 to *fifths*, $\frac{25}{5}$
Then add $\frac{1}{5}$ $\frac{1}{5}$
$\frac{26}{5}$

Reduce:

3. 12 to 4ths	7. 16 to halves	11. 25 to 4ths
4. 8 to 5ths	8. 13 to 3ds	12. 3 to 12ths
5. 7 to 10ths	9. 9 to 6ths	13. 12 to 3ds
6. 3 to 11ths	10. 10 to 10ths	14. 8 to 8ths

Reduce $7\frac{2}{9}$ to an improper fraction.

First change 7 to ninths, $\frac{63}{9}$
Then add $\frac{2}{9}$ $\frac{2}{9}$
$\frac{65}{9}$

Reduce to improper fractions:

15. $3\frac{2}{3}$	27. $8\frac{1}{9}$	39. $9\frac{4}{7}$	51. $35\frac{1}{11}$
16. $4\frac{1}{2}$	28. $7\frac{5}{11}$	40. $6\frac{7}{8}$	52. $17\frac{1}{9}$
17. $3\frac{3}{4}$	29. $8\frac{9}{10}$	41. $12\frac{2}{3}$	53. $25\frac{7}{8}$
18. $5\frac{1}{4}$	30. $9\frac{5}{6}$	42. $10\frac{4}{5}$	54. $15\frac{4}{11}$
19. $3\frac{4}{5}$	31. $10\frac{6}{7}$	43. $16\frac{4}{7}$	55. $27\frac{3}{15}$
20. $2\frac{3}{4}$	32. $11\frac{4}{5}$	44. $25\frac{3}{4}$	56. $41\frac{7}{8}$
21. $4\frac{3}{5}$	33. $12\frac{3}{5}$	45. $19\frac{3}{5}$	57. $22\frac{1}{3}$
22. $2\frac{5}{6}$	34. $10\frac{1}{4}$	46. $35\frac{4}{13}$	58. $59\frac{3}{8}$
23. $3\frac{5}{7}$	35. $11\frac{2}{3}$	47. $49\frac{7}{12}$	59. $47\frac{5}{6}$
24. $5\frac{7}{9}$	36. $12\frac{7}{8}$	48. $27\frac{3}{5}$	60. $4\frac{2}{3}$
25. $7\frac{5}{8}$	37. $5\frac{11}{12}$	49. $19\frac{7}{8}$	61. $5\frac{3}{4}$
26. $6\frac{3}{8}$	38. $11\frac{4}{5}$	50. $28\frac{3}{15}$	62. $11\frac{3}{10}$

Reduction of Improper Fractions to Integers or Mixed Numbers

1. A fraction indicates what operation?
2. What is the numerator? The denominator?

Reduce by performing the indicated operation :

3. $\frac{6}{2}$	7. $\frac{14}{3}$	11. $\frac{40}{8}$	15. $\frac{124}{2}$	19. $\frac{63}{8}$
4. $\frac{6}{3}$	8. $\frac{15}{5}$	12. $\frac{51}{3}$	16. $\frac{46}{11}$	20. $\frac{58}{9}$
5. $\frac{7}{2}$	9. $\frac{25}{5}$	13. $\frac{73}{7}$	17. $\frac{72}{12}$	21. $\frac{34}{7}$
6. $\frac{10}{4}$	10. $\frac{39}{7}$	14. $\frac{90}{9}$	18. $\frac{42}{10}$	22. $\frac{23}{2}$

A mixed number whose fractional part is in its lowest terms is in its **simplest form.**

Reduce to integers or to mixed numbers in simplest form :

23. $\frac{83}{4}$	28. $\frac{70}{35}$	33. $\frac{893}{46}$	38. $\frac{497}{67}$	43. $\frac{398}{75}$
24. $\frac{74}{25}$	29. $\frac{85}{16}$	34. $\frac{912}{89}$	39. $\frac{234}{78}$	44. $\frac{387}{26}$
25. $\frac{210}{18}$	30. $\frac{292}{14}$	35. $\frac{378}{18}$	40. $\frac{159}{50}$	45. $\frac{197}{12}$
26. $\frac{72}{22}$	31. $\frac{807}{27}$	36. $\frac{219}{16}$	41. $\frac{382}{24}$	46. $\frac{384}{29}$
27. $\frac{65}{38}$	32. $\frac{360}{30}$	37. $\frac{1216}{20}$	42. $\frac{180}{9}$	47. $\frac{380}{38}$

Reduction of Decimals to Common Fractions

Any decimal may be written as a fraction by removing the decimal point and writing the proper denominator. It may then be reduced to its lowest terms.

Reduce to common fractions in simplest form :

48. .28	54. .375	60. .0054	66. .875
49. .235	55. .55	61. .250	67. .00625
50. .75	56. .0025	62. .1375	68. .8325
51. .164	57. .56	63. .0425	69. .72
52. .82	58. .68	64. .125	70. .0625
53. .138	59. .075	65. .625	71. .455

Reduction of Common Fractions to Decimals

Since a fraction is an expression of division a common fraction may be reduced to a decimal by dividing its numerator by its denominator. Before dividing, place a decimal point after the numerator. Annex zeros as they are needed.

$\frac{7}{16} = 7.0000 \div 16 = .4375$; $39\frac{7}{16} = 39.4375$

Reduce to decimals :

1. $\frac{7}{8}$	**5.** $\frac{3}{80}$	**9.** $\frac{43}{80}$	**13.** $13\frac{7}{20}$
2. $\frac{9}{16}$	**6.** $\frac{4}{25}$	**10.** $2\frac{3}{32}$	**14.** $19\frac{5}{32}$
3. $8\frac{1}{16}$	**7.** $\frac{5}{40}$	**11.** $\frac{11}{250}$	**15.** $12\frac{3}{125}$
4. $\frac{3}{20}$	**8.** $\frac{47}{64}$	**12.** $12\frac{9}{25}$	**16.** $\frac{1}{625}$

A Common Fraction within a Decimal

People often use a common fraction as a part of a decimal; as, $.06\frac{1}{4}$, $.07\frac{1}{8}$, $.3\frac{1}{3}$, $.004\frac{1}{2}$.

In addition and subtraction of such decimals it is generally most convenient to first change them to entire decimals. This is often true also in multiplication and division of such decimals. For example, if we are required to add $.03\frac{1}{8}$ and $.6\frac{3}{4}$, it is easier to add them if we first change them to .03125 and .675.

The method of making this change may be illustrated with the number $.35\frac{1}{2}$. The fraction $\frac{1}{2}$ is in hundredths' place, and hence is equal to $\frac{1}{2}$ of $\frac{1}{100}$, or $\frac{1}{200}$, or .005. Therefore $.35\frac{1}{2} = .355$.

Reduce to entire decimals :

17. $.9\frac{1}{2}$	**22.** $.6\frac{1}{4}$	**27.** $.7\frac{3}{4}$	**32.** $.4\frac{1}{8}$
18. $.09\frac{1}{2}$	**23.** $.06\frac{1}{4}$	**28.** $.07\frac{3}{4}$	**33.** $.0\frac{1}{8}$
19. $.009\frac{1}{2}$	**24.** $.006\frac{1}{4}$	**29.** $.007\frac{3}{4}$	**34.** $.00\frac{1}{8}$
20. $.3\frac{2}{5}$	**25.** $.24\frac{4}{5}$	**30.** $.001\frac{7}{8}$	**35.** $.090\frac{4}{5}$
21. $.07\frac{3}{8}$	**26.** $.6\frac{1}{8}$	**31.** $.410\frac{1}{4}$	**36.** $.156\frac{3}{8}$

Least Common Denominator

Fractions whose denominators are alike are said to have a **common denominator**, and are called **similar fractions.**

The smallest common denominator two or more fractions can have is their **least common denominator.**

1. Reduce $\frac{7}{8}$, $\frac{11}{12}$, and $\frac{5}{18}$ to fractions having their least common denominator.

$8 = 2 \times 2 \times 2$
$12 = 2 \times 2 \times 3$
$18 = 2 \times 3 \times 3$
$2 \times 2 \times 2 \times 3 \times 3 = 72$, L.C.M.

$\frac{7}{8} = \frac{63}{72}$
$\frac{11}{12} = \frac{66}{72}$
$\frac{5}{18} = \frac{20}{72}$

Reduce to fractions having their least common denominator:

2. $\frac{2}{3}, \frac{5}{6}, \frac{7}{12}$
3. $\frac{7}{8}, \frac{5}{6}, \frac{4}{9}$
4. $\frac{5}{7}, \frac{2}{3}, \frac{2}{5}$
5. $\frac{5}{6}, \frac{7}{8}, \frac{7}{12}$
6. $\frac{3}{4}, \frac{7}{8}, \frac{7}{16}$
7. $\frac{5}{10}, \frac{5}{9}, \frac{1}{12}$
8. $\frac{4}{5}, \frac{5}{12}, \frac{3}{20}, \frac{5}{60}$
9. $\frac{5}{6}, \frac{7}{8}, \frac{5}{9}$
10. $\frac{4}{5}, \frac{9}{10}, \frac{6}{50}$

ADDITION

1. What is the sum of one *seventh* and three *sevenths?* 2 *sevenths* and 4 *sevenths?* $\frac{1}{7}$ and $\frac{5}{7}$?

2. What is the sum of $\frac{1}{5}$, $\frac{3}{5}$, and $\frac{4}{5}$? Reduce it to a mixed number.

3. What is the sum of $\frac{1}{2}$ and $\frac{3}{4}$? $\frac{1}{3}$ and $\frac{1}{2}$?

Add:

4. $\frac{3}{4}$ and $\frac{7}{8}$
5. $\frac{1}{4}$ and $\frac{5}{6}$
6. $\frac{2}{3}$ and $\frac{3}{4}$
7. $\frac{2}{5}$ and $\frac{7}{20}$
8. $\frac{5}{6}$ and $\frac{2}{3}$
9. $\frac{5}{12}$ and $\frac{3}{4}$
10. $\frac{2}{15}$ and $\frac{2}{3}$
11. $\frac{1}{2}$ and $\frac{5}{8}$
12. $\frac{2}{3}$ and $\frac{7}{9}$
13. $\frac{2}{3}$ and $\frac{5}{12}$
14. $\frac{4}{5}$ and $\frac{7}{10}$
15. $\frac{5}{12}$ and $\frac{3}{8}$

Add :

1. $2\frac{1}{3}$, $3\frac{1}{5}$, $7\frac{1}{8}$

2. $4\frac{2}{3}$, $2\frac{1}{4}$, $9\frac{1}{2}$

3. $6\frac{3}{5}$, $3\frac{7}{10}$, $20\frac{2}{15}$

4. $8\frac{1}{4}$, $5\frac{5}{16}$, $12\frac{3}{8}$

5. $13\frac{1}{3}$, $6\frac{4}{9}$, $9\frac{5}{12}$

6. $4\frac{5}{12}$, $8\frac{1}{2}$, $5\frac{3}{4}$

7. $9\frac{1}{8}$, $7\frac{1}{10}$, $14\frac{3}{20}$

8. $3\frac{1}{3}$, $5\frac{3}{8}$, $4\frac{2}{3}$

9. $16\frac{1}{6}$, $12\frac{1}{8}$, $4\frac{3}{4}$

10. $2\frac{1}{2}$, $4\frac{2}{3}$, $7\frac{1}{6}$

11. $3\frac{1}{5}$, $18\frac{4}{15}$, $2\frac{3}{20}$

12. $6\frac{3}{4}$, $5\frac{1}{6}$, $7\frac{5}{12}$

13. $9\frac{3}{8}$, $3\frac{3}{4}$, $2\frac{7}{16}$

14. $8\frac{5}{6}$, $14\frac{2}{3}$, 26

15. $13\frac{1}{3}$, $2\frac{3}{4}$, $1\frac{5}{12}$

16. $4\frac{1}{2}$, $7\frac{3}{4}$, $1\frac{5}{12}$

17. $5\frac{1}{4}$, $12\frac{1}{2}$, $3\frac{3}{8}$

18. $16\frac{2}{3}$, 20, $2\frac{5}{8}$

19. $2\frac{4}{5}$, $\frac{7}{10}$, $2\frac{1}{2}$

20. 3, $5\frac{2}{3}$, $9\frac{3}{5}$

21. 21, $13\frac{1}{5}$, $\frac{3}{20}$

22. $8\frac{1}{2}$, $1\frac{3}{8}$, $\frac{5}{8}$

23. $9\frac{1}{2}$, $12\frac{1}{3}$, $2\frac{1}{5}$

24. $6\frac{1}{3}$, $1\frac{1}{4}$, $\frac{3}{4}$

25. $1\frac{5}{6}$, $4\frac{2}{3}$, $1\frac{5}{12}$

26. $18\frac{7}{20}$, $9\frac{3}{10}$, $9\frac{1}{2}$

27. $9\frac{7}{8}$, 4, $4\frac{1}{3}$

28. $6\frac{1}{4}$, $3\frac{1}{2}$, $2\frac{5}{12}$

29. $30\frac{3}{4}$, $2\frac{5}{12}$, $4\frac{1}{6}$

30. $5\frac{3}{4}$, $\frac{7}{16}$, $2\frac{3}{8}$

31. $\frac{1}{3}$, $3\frac{2}{3}$, $3\frac{5}{9}$

32. 7, $3\frac{1}{2}$, $10\frac{5}{12}$

A number is in its **simplest form** when (1) it is an integer, (2) a proper fraction in its lowest terms, or (3) a mixed number whose fractional part is in its lowest terms.

Add and reduce sums to simplest form:

1. $\frac{1}{8}$, $\frac{1}{10}$, and $\frac{1}{12}$
2. $\frac{5}{7}$, $\frac{1}{2}$, and $\frac{3}{14}$
3. $\frac{2}{5}$, $\frac{2}{3}$, and $\frac{4}{15}$
4. $\frac{5}{6}$, $\frac{3}{4}$, and $\frac{2}{3}$
5. $\frac{1}{8}$, $\frac{3}{4}$, and $\frac{1}{2}$
6. $\frac{1}{8}$, $\frac{3}{4}$, and $\frac{5}{6}$
7. $\frac{2}{3}$, $\frac{5}{9}$, and $\frac{7}{18}$
8. $\frac{2}{3}$, $\frac{1}{8}$, and $\frac{5}{12}$
9. $\frac{3}{4}$, $\frac{4}{5}$, and $\frac{2}{3}$
10. $\frac{3}{5}$, $\frac{1}{2}$, and $\frac{9}{10}$
11. $\frac{1}{7}$, $\frac{3}{4}$, and $\frac{3}{14}$
12. $\frac{5}{12}$, $\frac{1}{2}$, and $\frac{5}{4}$

In adding mixed numbers, add the fractions first and reduce to simplest form.

Add:

13. $2\frac{1}{3}$, $3\frac{1}{8}$
14. $4\frac{1}{2}$, $2\frac{1}{3}$
15. $2\frac{1}{8}$, $3\frac{1}{4}$
16. $3\frac{1}{3}$, $5\frac{2}{5}$
17. $4\frac{7}{9}$, $6\frac{2}{3}$
18. $8\frac{1}{5}$, $7\frac{1}{3}$
19. $6\frac{3}{4}$, $4\frac{5}{8}$
20. $15\frac{7}{8}$, $14\frac{5}{6}$
21. $11\frac{5}{6}$, $12\frac{3}{4}$
22. $17\frac{1}{3}$, $2\frac{5}{6}$
23. $3\frac{2}{5}$, $5\frac{1}{3}$, $7\frac{3}{10}$
24. $5\frac{3}{5}$, $8\frac{3}{10}$, $4\frac{4}{15}$
25. $37\frac{1}{2}$, $33\frac{1}{3}$
26. $5\frac{1}{8}$, $15\frac{1}{2}$
27. $25\frac{1}{4}$, $16\frac{1}{3}$
28. $6\frac{1}{2}$, $14\frac{5}{6}$
29. $12\frac{2}{3}$, $4\frac{5}{8}$
30. $6\frac{3}{4}$, $5\frac{2}{3}$

Add:

31.
$48\frac{1}{2}$
$13\frac{3}{4}$
$5\frac{3}{8}$

32.
$16\frac{1}{6}$
$12\frac{2}{3}$
$14\frac{1}{2}$

33.
$31\frac{1}{3}$
$16\frac{1}{2}$
$12\frac{1}{6}$

34.
$9\frac{1}{8}$
$10\frac{1}{4}$
$7\frac{1}{2}$

Add:

35.
$73\frac{5}{8}$
$64\frac{2}{3}$
$39\frac{1}{2}$
$42\frac{3}{4}$

36.
$11\frac{7}{9}$
$13\frac{1}{3}$
$62\frac{1}{2}$
$15\frac{2}{3}$

37.
$18\frac{7}{8}$
$97\frac{1}{3}$
$36\frac{1}{6}$
$43\frac{3}{4}$

38.
$342\frac{3}{7}$
$59\frac{1}{3}$
$42\frac{1}{2}$
$38\frac{5}{6}$

39. John saves $\$\frac{7}{8}$ a day and James $\$1\frac{1}{2}$. How much do both save?

40. A clerk sold $\frac{3}{4}$ of a pound of tea to one customer, $\frac{1}{4}$ lb. to another, and $\frac{5}{8}$ lb. to another. How much did he sell in all?

41. Ione deposited $\$3\frac{1}{4}$ in the bank, Verda $\$1\frac{1}{2}$, and Florence $\$\frac{3}{4}$. How much did all deposit?

42. Ben rode his wheel $5\frac{2}{3}$ miles on Monday and $6\frac{1}{2}$ miles on Tuesday. How many miles did he ride in the two days?

43. Fred in making the model of a house frame made pieces of these lengths, $2\frac{3}{4}$ in., $7\frac{5}{8}$ in., $7\frac{5}{8}$ in., $8\frac{9}{16}$ in., $8\frac{9}{16}$ in., $5\frac{7}{8}$ in. If there was a waste of $4\frac{7}{16}$ in. and $18\frac{3}{8}$ in. left, how long was the piece with which he began?

44. Henry and Robert ran from the same point. Henry ran east $25\frac{3}{4}$ rods, and Robert ran west $26\frac{5}{8}$ rods. How far apart were they?

45. A floor is $12\frac{3}{4}$ ft. long and $9\frac{11}{12}$ ft. wide. What is the length of the four sides?

46. Find the sum of $\frac{3}{4}$, $\frac{5}{6}$, $\frac{7}{8}$, and $\frac{2}{3}$.

47. A man bought hay from three farmers. From the first he bought $10\frac{3}{20}$ tons, from the second $18\frac{9}{10}$ tons, and from the third $16\frac{3}{4}$ tons. How many tons did he buy?

SUBTRACTION

1. How much more is five *sevenths* than 2 *sevenths?* 6 *sevenths* than 4 *sevenths?* $\frac{6}{7}$ than $\frac{3}{7}$?

2. What is the difference between $\frac{7}{8}$ and $\frac{3}{8}$? Express it in lowest terms.

3. Subtract $\frac{1}{3}$ from $\frac{1}{5}$; $\frac{3}{8}$ from $\frac{3}{4}$.

Find the difference :

4. $\frac{5}{6} - \frac{7}{9}$
5. $\frac{2}{3} - \frac{3}{7}$
6. $\frac{17}{20} - \frac{7}{12}$
7. $4\frac{1}{4} - \frac{6}{7}$
8. $\frac{11}{12} - \frac{3}{8}$
9. $\frac{1}{2} - \frac{3}{14}$
10. $\frac{1}{3} - \frac{2}{7}$
11. $\frac{4}{9} - \frac{1}{6}$
12. $\frac{7}{8} - \frac{3}{4}$
13. $\frac{1}{3} - \frac{1}{15}$
14. $\frac{6}{7} - \frac{2}{3}$
15. $\frac{7}{16} - \frac{1}{4}$
16. $\frac{2}{3} - \frac{1}{8}$
17. $\frac{4}{5} - \frac{3}{10}$
18. $\frac{13}{20} - \frac{7}{12}$
19. $\frac{2}{3} - \frac{1}{7}$

1. Subtract $6\frac{3}{8}$ from 9.

$$\begin{array}{r} 9 \\ 6\frac{3}{8} \\ \hline 2\frac{5}{8} \end{array}$$

Say "$\frac{3}{8}$ and $\frac{5}{8}$ (write $\frac{5}{8}$) $= \frac{8}{8}$.
7 and 2 (write 2) $= 9$."

Subtract :

2. $\begin{array}{r} 4 \\ 3\frac{1}{8} \\ \hline \end{array}$	11. $\begin{array}{r} 5 \\ 4\frac{1}{2} \\ \hline \end{array}$	20. $\begin{array}{r} 3 \\ 2\frac{3}{7} \\ \hline \end{array}$	29. $\begin{array}{r} 6 \\ 5\frac{1}{8} \\ \hline \end{array}$	38. $\begin{array}{r} 9 \\ 8\frac{11}{12} \\ \hline \end{array}$
3. $\begin{array}{r} 2 \\ 1\frac{1}{3} \\ \hline \end{array}$	12. $\begin{array}{r} 12 \\ 11\frac{1}{15} \\ \hline \end{array}$	21. $\begin{array}{r} 14 \\ 13\frac{1}{6} \\ \hline \end{array}$	30. $\begin{array}{r} 8 \\ 7\frac{1}{16} \\ \hline \end{array}$	39. $\begin{array}{r} 15 \\ 14\frac{7}{15} \\ \hline \end{array}$
4. $\begin{array}{r} 6 \\ 5\frac{5}{6} \\ \hline \end{array}$	13. $\begin{array}{r} 9 \\ 8\frac{2}{3} \\ \hline \end{array}$	22. $\begin{array}{r} 5 \\ 4\frac{14}{51} \\ \hline \end{array}$	31. $\begin{array}{r} 4 \\ 3\frac{3}{16} \\ \hline \end{array}$	40. $\begin{array}{r} 13 \\ 12\frac{3}{8} \\ \hline \end{array}$
5. $\begin{array}{r} 5 \\ 4\frac{1}{4} \\ \hline \end{array}$	14. $\begin{array}{r} 7 \\ 6\frac{7}{12} \\ \hline \end{array}$	23. $\begin{array}{r} 7 \\ 6\frac{3}{4} \\ \hline \end{array}$	32. $\begin{array}{r} 15 \\ 14\frac{5}{8} \\ \hline \end{array}$	41. $\begin{array}{r} 11 \\ 10\frac{7}{10} \\ \hline \end{array}$
6. $\begin{array}{r} 8 \\ 7\frac{2}{5} \\ \hline \end{array}$	15. $\begin{array}{r} 19 \\ 18\frac{11}{15} \\ \hline \end{array}$	24. $\begin{array}{r} 10 \\ 9\frac{1}{5} \\ \hline \end{array}$	33. $\begin{array}{r} 2 \\ 1\frac{7}{8} \\ \hline \end{array}$	42. $\begin{array}{r} 6 \\ 5\frac{2}{9} \\ \hline \end{array}$
7. $\begin{array}{r} 12 \\ 11\frac{4}{15} \\ \hline \end{array}$	16. $\begin{array}{r} 8 \\ 7\frac{5}{9} \\ \hline \end{array}$	25. $\begin{array}{r} 6 \\ 5\frac{3}{10} \\ \hline \end{array}$	34. $\begin{array}{r} 4 \\ 3\frac{5}{16} \\ \hline \end{array}$	43. $\begin{array}{r} 10 \\ 9\frac{13}{15} \\ \hline \end{array}$
8. $\begin{array}{r} 18 \\ 17\frac{1}{20} \\ \hline \end{array}$	17. $\begin{array}{r} 12 \\ 11\frac{9}{16} \\ \hline \end{array}$	26. $\begin{array}{r} 2 \\ 1\frac{7}{16} \\ \hline \end{array}$	35. $\begin{array}{r} 13 \\ 12\frac{3}{5} \\ \hline \end{array}$	44. $\begin{array}{r} 16 \\ 15\frac{7}{9} \\ \hline \end{array}$
9. $\begin{array}{r} 6 \\ 5\frac{15}{16} \\ \hline \end{array}$	18. $\begin{array}{r} 3 \\ 2\frac{4}{5} \\ \hline \end{array}$	27. $\begin{array}{r} 6 \\ 5\frac{1}{10} \\ \hline \end{array}$	36. $\begin{array}{r} 8 \\ 7\frac{5}{12} \\ \hline \end{array}$	45. $\begin{array}{r} 3 \\ 2\frac{11}{16} \\ \hline \end{array}$
10. $\begin{array}{r} 15 \\ 14\frac{3}{20} \\ \hline \end{array}$	19. $\begin{array}{r} 5 \\ 4\frac{13}{16} \\ \hline \end{array}$	28. $\begin{array}{r} 5 \\ 4\frac{1}{12} \\ \hline \end{array}$	37. $\begin{array}{r} 10 \\ 9\frac{8}{15} \\ \hline \end{array}$	46. $\begin{array}{r} 17 \\ 2\frac{3}{8} \\ \hline \end{array}$

1. Subtract $\frac{3}{8}$ from $4\frac{1}{4}$.

$4\frac{1}{4} = 4\frac{2}{8}$

$\frac{3}{8} = \frac{3}{8}$

$3\frac{7}{8}$

Say "$\frac{3}{8}$ and $\frac{7}{8}$ (write $\frac{7}{8}$) $= \frac{10}{8}$ $(\frac{8}{8} + \frac{2}{8})$. 1 and 3 (write 3) $= 4$."

Subtract :

2. $3\frac{1}{5}$	7. $9\frac{1}{6}$	12. $12\frac{2}{5}$	17. $6\frac{3}{10}$	22. $10\frac{1}{3}$
$\frac{4}{5}$	$\frac{1}{2}$	$\frac{8}{15}$	$\frac{4}{5}$	$\frac{5}{9}$
3. $5\frac{1}{4}$	8. $14\frac{1}{2}$	13. $17\frac{3}{8}$	18. $9\frac{3}{10}$	23. $20\frac{1}{2}$
$\frac{1}{2}$	$\frac{7}{8}$	$\frac{9}{16}$	$\frac{1}{2}$	$\frac{15}{16}$
4. $14\frac{1}{3}$	9. $2\frac{1}{3}$	14. $4\frac{3}{16}$	19. $6\frac{1}{10}$	24. $3\frac{3}{16}$
$\frac{2}{3}$	$\frac{5}{6}$	$\frac{5}{8}$	$\frac{1}{2}$	$\frac{1}{3}$
5. $5\frac{1}{8}$	10. $11\frac{2}{5}$	15. $2\frac{7}{16}$	20. $4\frac{3}{20}$	25. $11\frac{1}{3}$
$\frac{5}{8}$	$\frac{3}{5}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{9}{10}$
6. $4\frac{3}{5}$	11. $9\frac{2}{5}$	16. $16\frac{1}{10}$	21. $7\frac{1}{20}$	26. $6\frac{1}{2}$
$\frac{4}{5}$	$\frac{7}{10}$	$\frac{1}{5}$	$\frac{7}{8}$	$\frac{3}{8}$

27. Subtract $7\frac{3}{5}$ from $9\frac{1}{3}$.

$9\frac{1}{3} = 9\frac{5}{15}$

$7\frac{3}{5} = 7\frac{9}{15}$

$1\frac{11}{15}$

Say "$\frac{9}{15}$ and $\frac{11}{15}$ (write $\frac{11}{15}$) $= \frac{20}{15}$ $(\frac{15}{15} + \frac{5}{15})$. 8 and 1 (write 1) $= 9$."

Subtract :

28. $4\frac{1}{2}$	30. $8\frac{3}{8}$	32. $14\frac{3}{8}$	34. $7\frac{1}{2}$	36. $6\frac{1}{2}$
$2\frac{1}{3}$	$1\frac{5}{8}$	$6\frac{5}{12}$	$4\frac{3}{4}$	$3\frac{5}{8}$
29. $6\frac{1}{3}$	31. $6\frac{1}{10}$	33. $5\frac{3}{8}$	35. $13\frac{5}{16}$	37. $11\frac{2}{15}$
$5\frac{2}{3}$	$4\frac{1}{5}$	$3\frac{1}{2}$	$9\frac{1}{2}$	$6\frac{2}{3}$

Problems

1. What is the remainder when $\frac{5}{7}$ is subtracted from $\frac{3}{4}$?

2. A field of $3\frac{7}{8}$ acres was planted in corn and potatoes. There were $1\frac{3}{4}$ acres of potatoes. How many acres of corn were there?

3. After spending $\$3\frac{3}{4}$ in one store and $\$5\frac{1}{2}$ in another, how much change did Mrs. Crahan have left from a ten-dollar bill?

4. From a cask containing 42 gallons of oil I sell $8\frac{1}{4}$ gallons, $17\frac{1}{2}$ gallons, and $5\frac{3}{8}$ gallons. How much oil remains in the cask?

5. John had an allowance of $5 a month. He spent $\$1\frac{3}{5}$ for car fare, $\$\frac{3}{4}$ for candy, and $\$1\frac{1}{4}$ for school supplies. How much money did he have left?

6. Mary had 4 yards of serge to make a dress. It took $1\frac{3}{4}$ yards for the skirt, $\frac{1}{2}$ yard for the sleeves, and $1\frac{1}{3}$ yards for the waist. How many yards were left?

7. Four truck loads of coal weighed as follows: $2\frac{1}{4}$ tons, $1\frac{4}{5}$ tons, $2\frac{2}{5}$ tons and $1\frac{3}{5}$ tons. What was the total weight of the four loads? What must a fifth load weigh to make a total of ten tons?

8. Mrs. Brown bought $3\frac{1}{2}$ bushels of turnips. She sold $1\frac{3}{4}$ bushels to Mrs. Johnson. How many bushels did she have left?

9. From a sack of flour weighing $49\frac{1}{2}$ pounds $7\frac{3}{4}$ pounds have been used. How many pounds of flour remain?

10. Kelly's Coal Company had to deliver $1\frac{1}{2}$ tons of chestnut coal to Mr. Smith and $1\frac{1}{4}$ tons to Mr. Thompson. The loaded truck weighed $4\frac{4}{5}$ tons. How much did the truck weigh when empty?

MULTIPLICATION

The Product of a Fraction and an Integer

1. What is 2 times $\frac{1}{3}$? $3 \times \frac{2}{7}$? $5 \times \frac{3}{4}$? $4 \times \frac{4}{5}$?

2. In how many ways may we multiply a fraction by an integer?

In the following examples state whether you multiply the numerator or divide the denominator. Give the product.

3. $3 \times \frac{3}{5}$	**6.** $5 \times \frac{3}{10}$	**9.** $4 \times \frac{5}{6}$	**12.** $8 \times \frac{5}{7}$
4. $4 \times \frac{3}{12}$	**7.** $6 \times \frac{2}{3}$	**10.** $5 \times \frac{4}{5}$	**13.** $4 \times \frac{3}{16}$
5. $6 \times \frac{3}{8}$	**8.** $7 \times \frac{2}{5}$	**11.** $6 \times \frac{3}{7}$	**14.** $6 \times \frac{3}{5}$

In each of the above examples one factor is an integer, the other a fraction. The solution is the same whichever factor is taken as the multiplier. $\frac{2}{3} \times 7$ is the same as $7 \times \frac{2}{3}$. Following a fraction, the word *of* is sometimes used in place of $\times$. $\frac{2}{5}$ of 4 is the same as $\frac{2}{5} \times 4$.

Find the products. Cancel when convenient. Reduce to simplest form.

15. $\frac{7}{8} \times 4$	**19.** $\frac{4}{5}$ of 40	**23.** $\frac{4}{5} \times 9$	**27.** $\frac{3}{4}$ of 640
16. $\frac{5}{6} \times 10$	**20.** $\frac{6}{7}$ of 42	**24.** $\frac{15}{16} \times 80$	**28.** $\frac{4}{5}$ of 650
17. $\frac{8}{9} \times 18$	**21.** $\frac{3}{5}$ of 16	**25.** $\frac{7}{8} \times 32$	**29.** $\frac{3}{4}$ of 131
18. $\frac{4}{5} \times 7$	**22.** $\frac{5}{8}$ of 32	**26.** $\frac{2}{3} \times 13$	**30.** $\frac{5}{9}$ of 17

31. Mr. Jones raised 2000 tomato plants. He sold $\frac{7}{8}$ of them. How many did he sell?

32. Catherine earned \$12 and put $\frac{5}{6}$ of it in the bank. How much did she put in the bank?

33. In a mile there are 5280 ft. At that rate how many feet are there in $\frac{7}{10}$ of a mile?

34. Mr. Darrow owns $\frac{3}{4}$ of a mill worth \$6000. How much is Mr. Darrow's share worth?

35. Mary has \$320 and Elizabeth $\frac{3}{4}$ as much. How much has Elizabeth?

The Product of a Fraction and a Fraction

1. What is $\frac{1}{2}$ of half a dollar?
2. What is $\frac{1}{4}$ of 1? $\frac{1}{4}$ of $\frac{1}{2}$? $\frac{1}{3}$ of $\frac{1}{2}$?
3. What is $\frac{1}{2}$ of 2 thirds? $\frac{1}{3}$ of 3 fourths? $\frac{1}{3}$ of $\frac{3}{5}$?
4. What is $\frac{2}{3}$ of 3 fifths? $\frac{3}{4}$ of 4 fifths? $\frac{2}{3}$ of $\frac{3}{4}$?

$\frac{2}{3}$ of $3 = 2$. $\frac{2}{3}$ of 3 *fourths* $= 2$ *fourths*. $\frac{2}{4} = \frac{1}{2}$.

$\frac{2}{3} \times \frac{3}{4} = \frac{6}{12}$. $\frac{6}{12} = \frac{1}{2}$

Take the product of the numerators for a new numerator and the product of the denominators for a new denominator.

Since the numerators are *dividends* and the denominators are *divisors*, we may state the example thus:

$$\frac{2 \times 3}{3 \times 4} = ? \qquad \text{SOLUTION: } \frac{\cancel{2} \times \cancel{3}}{\cancel{3} \times \cancel{4}_{2}} = \frac{1}{2}.$$

Find the products. See how many you can solve orally.

5.	$\frac{1}{2} \times \frac{2}{3}$	11.	$\frac{5}{6}$ of $\frac{7}{8}$	17.	$\frac{3}{4}$ of $\frac{5}{6}$	23.	$\frac{15}{24} \times \frac{3}{5}$
6.	$\frac{4}{5} \times \frac{3}{4}$	12.	$\frac{3}{4} \times 44$	18.	$\frac{36}{45} \times \frac{5}{18}$	24.	$\frac{7}{9}$ of $\frac{63}{14}$
7.	$\frac{5}{6} \times \frac{3}{10}$	13.	$\frac{5}{8}$ of $\frac{9}{10}$	19.	$\frac{7}{16}$ of $\frac{80}{14}$	25.	$\frac{3}{8} \times \frac{4}{9}$
8.	$\frac{2}{3}$ of $\frac{3}{4}$	14.	$\frac{7}{9} \times \frac{9}{14}$	20.	$\frac{5}{6} \times \frac{9}{10}$	26.	$\frac{13}{20}$ of $\frac{4}{5}$
9.	$\frac{7}{8}$ of $\frac{3}{14}$	15.	$\frac{5}{6}$ of $\frac{12}{20}$	21.	$\frac{5}{16}$ of $\frac{3}{4}$	27.	$\frac{9}{14} \times \frac{2}{3}$
10.	$\frac{5}{9}$ of $\frac{7}{10}$	16.	$\frac{18}{36} \times \frac{4}{9}$	22.	$\frac{5}{6} \times \frac{5}{8}$	28.	$\frac{7}{16} \times \frac{32}{14}$

29. What part of a dollar is $\frac{1}{2}$ of $\frac{1}{2}$ of a dollar?

30. What is the cost of $\frac{3}{4}$ of a pound of coffee at $\$\frac{2}{5}$ a pound?

31. If I own $\frac{1}{2}$ of a farm and sell $\frac{1}{4}$ of my share, what part of the farm do I sell?

32. James earned $\$\frac{3}{4}$ and Henry $\frac{1}{3}$ as much. How much did Henry earn?

1. $\frac{4}{5} \times \frac{6}{7} \times \frac{5}{8} = ?$

STATEMENT: $\frac{4 \times 6 \times 5}{5 \times 7 \times 8} = ?$ SOLUTION: $\frac{\overset{3}{\cancel{4}} \times \cancel{6} \times \cancel{5}}{\cancel{5} \times 7 \times \underset{2}{\cancel{8}}} = \frac{3}{7}$.

Find the products:

2. $\frac{3}{4} \times \frac{7}{9}$ of $\frac{15}{28}$

3. $\frac{3}{8} \times \frac{20}{63} \times \frac{7}{44}$

4. $\frac{2}{3}$ of $\frac{9}{14}$ of $\frac{35}{40}$

5. $\frac{9}{11} \times \frac{22}{27}$ of $\frac{15}{28}$

6. $\frac{7}{10} \times \frac{8}{21}$ of $\frac{5}{56}$

7. $\frac{7}{8}$ of $\frac{5}{9}$ of $\frac{6}{7}$

8. $\frac{6}{7} \times \frac{33}{12} \times \frac{9}{11}$

9. $\frac{11}{2} \times \frac{3}{4} \times \frac{6}{11}$

10. $\frac{5}{18} \times \frac{7}{15} \times \frac{3}{14}$

11. $\frac{2}{5} \times \frac{3}{7} \times \frac{2}{11}$

Mixed numbers may be reduced to improper fractions and then multiplied.

12. $3\frac{1}{2} \times 2\frac{1}{8} \times 4\frac{4}{5} = ?$

STATEMENT: $\frac{7}{2} \times \frac{17}{8} \times \frac{24}{5} = ?$

SOLUTION: $\frac{7 \times 17 \times \overset{3}{\cancel{24}}}{2 \times \cancel{8} \times 5} = \frac{357}{10}$. $\frac{357}{10} = 35\frac{7}{10}$.

13. $3\frac{2}{3} \times 7\frac{1}{5} \times 1\frac{1}{9}$

14. $3\frac{8}{25} \times \frac{25}{42} \times \frac{21}{1}$

15. $2\frac{1}{3} \times 2\frac{4}{5} \times 1\frac{1}{14}$

16. $5\frac{3}{4} \times 2\frac{4}{5} \times 2\frac{1}{2}$

17. $5\frac{3}{5} \times 7\frac{1}{2} \times 4\frac{2}{3}$

18. $\frac{45}{1} \times 4\frac{1}{9} \times \frac{5}{15}$

19. $3\frac{1}{2} \times 1\frac{5}{7} \times 1\frac{7}{12}$

20. $2\frac{1}{5} \times 10\frac{1}{8} \times 2\frac{7}{9}$

The Product of a Mixed Number and an Integer

21. There are $31\frac{1}{2}$ gal. in a barrel. How many gallons are there in 25 barrels?

$31\frac{1}{2}$
25
$12\frac{1}{2}$
155
62
$787\frac{1}{2}$

Multiply 25 by $\frac{1}{2}$ for the first partial product.

25
$31\frac{1}{2}$
$12\frac{1}{2}$
25
75
$787\frac{1}{2}$

22. There are $16\frac{1}{2}$ feet in a rod. How many feet are there in 55 rods?

Problems

1. What is the cost of $3\frac{3}{4}$ bushels of potatoes at \$1.20 a bushel?

2. At $48\frac{3}{4}$ miles an hour how far can a train run in 8 hours?

3. At \$24 a ton what is the cost of $15\frac{3}{4}$ tons of hay?

4. At $\$\frac{5}{8}$ a gallon what will 16 gallons of sirup cost?

5. How much is $\frac{4}{5}$ of \$320?

6. How much is $\frac{1}{2}$ of \$320?

7. Mr. Case bought a horse, a wagon, and a harness for \$280. He paid $\frac{5}{8}$ of the money for the horse; what did it cost him?

8. At 3 for 5¢ what will 1 apple cost?

9. At 5 for 3¢ what will 1 apple cost?

10. What is the cost of 22 apples, at 3 apples for 5¢?

11. What is the cost of 22 apples at 5 apples for 3¢?

12. What will $3\frac{1}{2}$ gallons of gasoline cost at 28¢ a gallon?

13. What is the cost of $3\frac{1}{8}$ cords of wood at $\$3\frac{1}{8}$ per cord?

14. In a school of 840 pupils $\frac{4}{7}$ of the number were boys. How many boys were there in the school?

15. A mechanic who earns \$30 a week, pays $\frac{3}{10}$ of his earnings for board, and $\frac{1}{5}$ for clothing. How much does he pay for both board and clothing?

16. John has \$45 in the bank and draws out $\frac{2}{5}$ of it. What fraction of it remains in the bank? How much money remains in the bank?

17. What will 16 pairs of shoes cost at $\$3\frac{7}{8}$ a pair?

DIVISION

Dividing a Fraction by an Integer

1. Divide $\frac{8}{9}$ by 4. $\frac{8}{9} \div 4 = \frac{2}{9}$.

See Prin. 2, page 185.

2. Divide $\frac{4}{5}$ by 3. $\frac{4}{5} \div 3 = \frac{4}{15}$.

3. In how many ways may a fraction be divided? What are they?

Find the quotients. Give as many as you can orally.

4. $\frac{6}{7} \div 3$	**9.** $\frac{9}{16} \div 3$	**14.** $\frac{16}{17} \div 8$
5. $\frac{12}{13} \div 4$	**10.** $\frac{14}{15} \div 7$	**15.** $\frac{15}{21} \div 5$
6. $\frac{2}{3} \div 6$	**11.** $\frac{3}{4} \div 7$	**16.** $\frac{8}{9} \div 10$
7. $\frac{5}{8} \div 4$	**12.** $\frac{5}{8} \div 6$	**17.** $\frac{7}{16} \div 5$
8. $\frac{9}{10} \div 3$	**13.** $\frac{8}{11} \div 4$	**18.** $\frac{27}{81} \div 9$

Dividing a Fraction by a Fraction

19. $\frac{7}{8} \times \frac{5}{9} = ?$

$$\frac{7 \times 5}{8 \times 9} = \frac{35}{72}$$

In the multiplication of a fraction by a fraction we take the *product* of the numerators for a new numerator and the *product* of the denominators for a new *denominator*.

20. $\frac{35}{72} \div \frac{5}{9} = ?$

$$\frac{35 \div 5}{72 \div 9} = \frac{7}{8}$$

In this example $\frac{35}{72}$ is the dividend and $\frac{5}{9}$ is the divisor. We take the *quotient* of the numerators for a new numerator and the *quotient* of the denominators for a new denominator.

21. $\frac{35}{72} \div \frac{5}{9} = ?$

We may state this example $\frac{35 \div 5}{72 \div 9}$ or we may interchange the terms of the divisor and multiply thus:

$$\frac{\cancel{35}^{7}}{\cancel{72}_{8}} \times \frac{\cancel{9}}{\cancel{5}} = \frac{7}{8}$$

Observe that when we cancel we divide 35 by 5 and 72 by 9 as in the former statement. The latter method allows us to use cancellation, and is more convenient, especially when the terms of the dividend do not exactly contain those of the divisor.

To divide by a fraction interchange the terms of the divisor and multiply.

Give the quotients :

22. $\frac{8}{9} \div \frac{2}{3}$ **24.** $\frac{12}{20} \div 1\frac{1}{5}$ **26.** $\frac{16}{25} \div \frac{4}{7}$ **28.** $\frac{27}{40} \div \frac{9}{10}$

23. $\frac{10}{21} \div \frac{5}{7}$ **25.** $\frac{12}{24} \div \frac{3}{8}$ **27.** $\frac{12}{21} \div \frac{4}{7}$ **29.** $\frac{25}{21} \div \frac{5}{7}$

30. Divide $\frac{5}{8}$ by $\frac{2}{3}$.

STATEMENT: $\frac{5}{8} \div \frac{2}{3} = ?$ SOLUTION: $\frac{5}{8} \times \frac{3}{2} = \frac{15}{16}$.

31. $\frac{8}{9} \div \frac{4}{5}$ **35.** $\frac{7}{16} \div \frac{21}{40}$ **39.** $\frac{18}{35} \div \frac{27}{50}$ **43.** $\frac{7}{16} \div \frac{3}{9}$

32. $\frac{7}{8} \div \frac{5}{7}$ **36.** $\frac{25}{39} \div \frac{15}{26}$ **40.** $\frac{5}{18} \div \frac{3}{4}$ **44.** $\frac{16}{25} \div \frac{4}{5}$

33. $\frac{7}{18} \div \frac{7}{9}$ **37.** $\frac{8}{9} \div \frac{28}{45}$ **41.** $\frac{13}{15} \div \frac{4}{5}$ **45.** $\frac{14}{15} \div \frac{3}{5}$

34. $\frac{5}{6} \div \frac{1}{12}$ **38.** $\frac{4}{5} \div \frac{16}{25}$ **42.** $\frac{3}{5} \div \frac{9}{10}$ **46.** $\frac{16}{25} \div \frac{8}{15}$

Dividing an Integer by a Fraction

47. How many half dollars are there in one dollar? In two dollars? In five dollars?

48. $1 \div \frac{1}{2} = ?$ $2 \div \frac{1}{2} = ?$ $5 \div \frac{1}{2} = ?$

49. $1 \div \frac{1}{3} = ?$ $4 \div \frac{1}{3} = ?$ $4 \div \frac{2}{3} = ?$

The integer may be expressed as a fraction by giving it a denominator of 1. $4 \div \frac{2}{3} = \frac{4}{1} \times \frac{3}{2}$.

Find the quotient:

50. $4 \div \frac{4}{5}$ **52.** $17 \div \frac{7}{9}$ **54.** $30 \div \frac{3}{4}$ **56.** $35 \div \frac{5}{7}$

51. $21 \div \frac{7}{8}$ **53.** $35 \div \frac{5}{8}$ **55.** $27 \div \frac{6}{7}$ **57.** $39 \div \frac{13}{14}$

Problems

1. A sewing class made 5 bags, 17 calendars, and 3 handkerchief cases. Each bag required 22 inches of ribbon; each calendar 11 inches; and each handkerchief case 45 inches. At $4\frac{1}{2}$ cents a yard, what did the ribbon cost?

2. Miss Gray ordered the following material from Mr. Kidd so that 17 girls in her class could make bloomers for the gym: 142 yd. of sateen at 29 cents a yard; 13 spools of thread at $5\frac{1}{2}$ cents a spool; 29 yd. of elastic at 6 cents a yard; 17 doz. buttons at 12 cents a dozen. What was the cost of one pair of bloomers?

3. Martin went to the store for his mother and bought the following supplies: $5\frac{1}{8}$ lb. chicken at 42 cents a pound; 10 lb. squash at 3 cents a pound; 1 lb. butter at 58 cents a pound; and 1 lb of coffee at 60 cents a pound. What was the amount of his purchases and how much change did he receive if he gave the grocer a ten-dollar bill?

4. When Frances' father was building a house, he had to order the following material to complete it: 20 pounds of nails at 3¢ a pound; 21 windows at $5.20 each; 7 doors at $8 each; and 3500 bricks at 4¢ each. Find the total cost of this material.

5. Compute the cost of a cake made of the following ingredients: $\frac{1}{2}$ lb. sugar @ $.08 a pound; 5 oz. butter @ $.64 a pound; $\frac{1}{2}$ pt. milk @ $.12 a quart; 1 lb. flour at $.09 a pound; 2 eggs at $.84 a dozen; flavoring $.02.

6. Mr. Jones had his house painted. It took 5 days for 4 men to complete the work. Each man received $7 a day. The material cost $150. Find the cost.

7. From a piece of cloth containing 80 yd. the following pieces were cut: $10\frac{1}{2}$ yd.; $14\frac{2}{3}$ yd.; $8\frac{3}{8}$ yd.; $20\frac{1}{5}$ yd. How many yards were left?

Finding Part of a Number

1. Mr. Wise had \$9492 in the bank. He paid $\frac{5}{7}$ of it for a farm. What did the farm cost?

$$\frac{5}{7} \text{ of } \overset{1356}{\cancel{9492}} = \$6780$$

Find :

2. $\frac{5}{7}$ of 371	9. $\frac{3}{8}$ of 7120	16. $\frac{7}{8} \times 6336$
3. $\frac{2}{3}$ of 2520	10. $\frac{4}{9}$ of 342	17. $\frac{3}{5} \times 4330$
4. $\frac{3}{4}$ of 748	11. $\frac{5}{6}$ of 324	18. $\frac{4}{9} \times 639$
5. $\frac{2}{5}$ of 6755	12. $\frac{5}{6}$ of 8394	19. $\frac{8}{9} \times 1458$
6. $\frac{3}{5}$ of 8415	13. $\frac{5}{8}$ of 2096	20. $\frac{2}{3} \times 8649$
7. $\frac{1}{2}$ of 3758	14. $\frac{3}{8}$ of 7128	21. $\frac{5}{9} \times 4365$
8. $\frac{3}{7}$ of 623	15. $\frac{7}{9}$ of 7236	22. $\frac{3}{4} \times 4628$

23. Mrs. French bought 96 pounds of flour and used $\frac{3}{8}$ of it. How many pounds did she use?

24. Charlie's hens laid 245 eggs in one month. His mother bought $\frac{2}{5}$ of them. How many eggs did she buy?

25. Jessie bought $\frac{7}{8}$ of a yard of cloth at 96 cents a yard. What did she pay for it?

26. We had 189 days of school last year. Harold was absent $\frac{2}{9}$ of the time on account of illness. How many days of school did Harold miss?

27. In a school of 755 pupils, $\frac{3}{5}$ are boys. How many boys are there in the school?

28. Make problems using the numbers in Examples 2 to 8.

To Find a Fractional Part of a Number

When two factors are given, how is the product found?

$\frac{3}{4}$ of 24 = ?

The word *of* following a fraction means "*times.*" The number following " of " is a factor.

When one factor is less than 1 the product is less than the other factor. When one factor is greater than 1 the product is greater than the other factor.

Find the products :

1. $\frac{1}{3}$ of 12 = ?
2. $\frac{1}{4}$ of 8 = ?
3. $\frac{1}{5}$ of 15 = ?
4. $\frac{1}{6}$ of 18 = ?
5. $\frac{1}{8}$ of 16 = ?
6. $\frac{1}{7}$ of 14 = ?
7. $\frac{2}{3}$ of 12 = ?
8. $\frac{3}{4}$ of 16 = ?
9. $\frac{1}{8}$ of 64 = ?
10. $\frac{2}{3}$ of 36 = ?
11. $\frac{2}{5}$ of 40 = ?
12. $\frac{3}{8}$ of 48 = ?
13. $\frac{3}{4}$ of 96 = ?
14. $\frac{4}{5}$ of 150 = ?
15. $\frac{7}{8}$ of 120 = ?
16. $\frac{3}{8}$ of 640 = ?
17. $\frac{2}{15}$ of 108 = ?
18. $\frac{3}{4}$ of $3\frac{1}{4}$ = ?
19. $\frac{2}{3}$ of $\frac{5}{6}$ = ?
20. .25 of 56 = ?
21. $\frac{5}{8}$ of $7\frac{1}{2}$ = ?
22. $\frac{5}{11}$ of 77 = ?

23. If a ton of hay costs \$16, what does $\frac{3}{4}$ of a ton cost?

STATEMENT: $\frac{3}{4}$ of a ton will cost $\frac{3}{4}$ of \$16. $\frac{3}{4}$ of \$16 = ?

24. A basket of eggs was worth \$20, and $\frac{2}{5}$ of them were sold. How much was received?

25. $\frac{3}{5}$ of a basket of eggs worth \$20 were unsold. How many dollars' worth were unsold?

26. If I own $\frac{3}{4}$ of a business, and sell $\frac{1}{2}$ of my share, what part do I sell?

27. Find the cost of $\frac{5}{8}$ yd. of sheeting at $\$\frac{2}{5}$ per yard.

28. What will .5 yd. of ribbon cost at \$.75 a yard?

29. John earns $\$\frac{5}{8}$, and Henry $\frac{4}{5}$ as much. How much does Henry earn?

30. A man who owed \$7825 failed and could pay only $\frac{5}{8}$ of his debts. How much could he pay?

31. There were 50 words in Ione's spelling lesson. She spelled .98 of them correctly. How many did she spell correctly?

To Find what Fractional Part One Number is of Another

32. When a product and one of its two factors are given, how do we find the other factor?

What part of 24 = 18?

When the divisor is greater than the dividend, the quotient is less than 1. When the divisor is less than the dividend, the quotient is greater than 1.

The number following the word " of " is a factor.

33. What part of 4 = 2? Dividing the product, 2, by the given factor, $2 \div 4 = \frac{2}{4}$ or $\frac{1}{2}$.

What part of:

34. 6 is 3

35. 12 = 4

36. 6 = 4

37. 10 is 5

38. 20 is 4

39. 25 = 5

40. 36 is 6

41. 40 is 10

42. 24 is 8

43. $\frac{2}{3}$ is $\frac{1}{3}$

44. $\frac{5}{6}$ is $\frac{1}{6}$

45. $\frac{3}{4} = \frac{1}{4}$

Estimate the answer, solve, and test:

46. (? part) of 24 = 18. $18 \div 24 = \frac{18}{24}$ or $\frac{3}{4}$. *Ans.*

47. ? part of 15 = 10

48. ? part of 36 = 24

49. ? part of $\frac{8}{9} = \frac{2}{3}$.

Divide $\frac{2}{3}$ by $\frac{8}{9}$ thus: $\frac{\cancel{2}}{\cancel{3}} \times \frac{\overset{3}{\cancel{9}}}{\underset{4}{\cancel{8}}} = \frac{3}{4}$.

50. (? part) of $\frac{4}{5} = \frac{2}{3}$

51. (? part) of 55 = 33

52. (? part) of $4\frac{2}{3} = \frac{7}{9}$

53. (? part) of 81 = 36

54. (? part) of 56 is 35

55. 16 = (? part) of 86

56. 25 is (? part) of 125

57. (? part) of $5\frac{1}{3} = \frac{4}{9}$

58. What decimal part of 3.5 is .7?

59. 1.25 is what decimal part of 7.5?

60. A fruit grower gathered 64 bushels of apples and sold 48 bushels. What part of his apples did he sell?

STATEMENT: 48 is what part of 64? (? part) of 64 = 48. Product ÷ given factor = other factor.

$$48 \div 64 = \frac{48}{64} \text{ or } \frac{3}{4}.$$

61. Dick had 36 chickens and Harry bought 24 of them. What fraction of Dick's chickens did Harry buy?

62. Verda had 20¢ and spent 15¢. What part of her money did she spend?

63. At $45 an acre, what part of an acre of pasture can you buy for $25?

64. A bushel is 32 qt., and a peck is 8 qt. What part of a bushel is a peck?

To Find the Whole, when a Fractional Part, and Its Relation to the Whole, are Given

When a product and one of its two factors are given, how do we find the other factor?

$\frac{3}{4}$ of ? = 24

When the divisor is less than 1, the quotient is greater than the dividend. When the divisor is greater than 1, the quotient is less than the dividend.

Find the missing factor:

1. $\frac{1}{2} \times ? = 4$
2. $\frac{1}{4} \times ? = 12$
3. $\frac{1}{6} \times ? = 3$
4. $\frac{3}{4} \times ? = 9$
5. $\frac{2}{3}$ of ? = 4
6. $\frac{2}{3}$ of ? = 8
7. $\frac{3}{4} \times ? = 15$ $15 \div \frac{3}{4} = \overset{5}{\cancel{15}} \times \frac{4}{\cancel{3}}$ or 20.
8. $\frac{2}{3} \times ? = 16$
9. $\frac{5}{8}$ of ? = 25 quarts
10. .6 of ? = \$9
11. $\frac{6}{7} \times ? = 18$
12. $\frac{7}{8}$ of ? = \$21
13. 45 is $\frac{5}{9}$ of ?
14. $\frac{7}{9} \times ? = 28$
15. 24 = $\frac{4}{5}$ of ?

Make statements, estimate, and solve:

16. When $\frac{3}{4}$ of a ton of hay costs \$12, what is the cost of 1 ton?

STATEMENT: \$12 is the cost of $\frac{3}{4}$ ton. $\frac{3}{4} \times ? = \$12$. Product and factor given, to find the other factor.

$12 \div \frac{3}{4} = 12 \times \frac{4}{3} = 16$ \$16.

17. John had 42 marbles, which was $\frac{3}{4}$ as many as James had. How many did James have?

18. A farmer sold 24 cattle, which was $\frac{3}{8}$ of all he had. How many had he?

19. A farmer stored his entire crop of apples in the fall. In the spring he found that 45 bushels, or $\frac{3}{8}$ of his crop, were decayed. How many bushels were stored?

20. 27 pupils of the 6th grade were promoted. This was .90 of the entire class. How many were there in the class?

21. A merchant lost \$13.15 on damaged goods. This was .125 of their cost. What did they cost?

22. If I pay $\$5\frac{1}{2}$ for $\frac{5}{8}$ of a ton of coal, what is the price per ton?

23. A boy earned 60 cents, which was $\frac{1}{10}$ of all he had saved. How much had he saved?

24. Peter has saved $\$10\frac{3}{8}$, which is $\frac{1}{4}$ of the amount needed to pay for a new wheel. What does the wheel cost?

25. The village library loaned in one week 623 books, which was $\frac{7}{8}$ of the number loaned the week before. How many were loaned the week before?

26. Of 19,000 lb. of milk delivered at a creamery 323 lb. were rejected as below standard. What decimal part was rejected?

27. A merchant's loss in bad accounts for one month was \$13.84. He lost $\frac{1}{20}$ of his accounts. What were his accounts for the month?

28. In a certain district .42 of the population, or 273 people, are members of the Red Cross. What is the population of the district?

29. When a man has paid \$90 on a debt of \$240, what part has he paid?

30. In a grade containing 45 pupils, 27 are girls. The girls are what fractional part of the grade?

FRACTIONAL PARTS OF 100

Since the dollar (100 cents) is the unit by which we measure the values of commodities used in trade, people have adopted the practice of expressing the prices of articles in sums which are exact fractions of one dollar. Very often, therefore, we may shorten the work of computation by using the equivalent fraction of one dollar, rather than the number of cents.

For example, $12\frac{1}{2}$ cents is $\frac{1}{8}$ of a dollar. When raisins are sold at $12\frac{1}{2}$ cents a pound, 30 lb. of raisins cost 30 times $\$\frac{1}{8}$, or $\$\frac{30}{8}$, or $\$3\frac{3}{4}$.

One of the equal parts of a number is an **aliquot part** of the number.

6 in. is an aliquot part of 12 in. because it is $\frac{1}{2}$ of 12 in.

$33\frac{1}{3}$ cents is an aliquot part of \$1 because it is $\frac{1}{3}$ of a dollar.

Certain aliquot parts and other fractions of \$1, expressed as cents, should be known perfectly, so as to be used quickly in calculation.

Memorize the following:

$5\ ¢ = \$\frac{1}{20}$	$33\frac{1}{3}¢ = \$\frac{1}{3}$	$16\frac{2}{3}¢ = \$\frac{1}{6}$
$6\frac{1}{4}¢ = \$\frac{1}{16}$	$37\frac{1}{2}¢ = \$\frac{3}{8}$	$25\ ¢ = \$\frac{1}{4}$
$8\frac{1}{3}¢ = \$\frac{1}{12}$	$50\ ¢ = \$\frac{1}{2}$	$75\ ¢ = \$\frac{3}{4}$
$10\ ¢ = \$\frac{1}{10}$	$62\frac{1}{2}¢ = \$\frac{5}{8}$	$87\frac{1}{2}¢ = \$\frac{7}{8}$
$12\frac{1}{2}¢ = \$\frac{1}{8}$	$66\frac{2}{3}¢ = \$\frac{2}{3}$	

Answer rapidly:

1. $6\frac{1}{4}¢ \times 16$	5. $12\frac{1}{2}¢ \times 32$	9. $16\frac{2}{3}¢ \times 24$
2. $6\frac{1}{4}¢ \times 24$	6. $33\frac{1}{3}¢ \times 12$	10. $25\ ¢ \times 15$
3. $8\frac{1}{3}¢ \times 36$	7. $62\frac{1}{2}¢ \times 40$	11. $75\ ¢ \times 28$
4. $8\frac{1}{3}¢ \times 6$	8. $66\frac{2}{3}¢ \times 18$	12. $87\frac{1}{2}¢ \times 48$

Problems Using Fractional Parts of 100

1. What part of \$1 is $12\frac{1}{2}¢$? What will 24 cans of milk cost at $12\frac{1}{2}¢$ apiece?

2. At $12\frac{1}{2}¢$ a pound what will 24 lb. of fish cost?

3. What will 24 yd. of pongee cost at $66\frac{2}{3}¢$ a yard?

4. How much will 16 yd. of silk cost at $87\frac{1}{2}¢$ a yard?

Find the cost of:

5. 250 lb. of butter at $37\frac{1}{2}$ cents a pound.

6. 150 lb. of honey at 25 cents a pound.

7. 640 bars of soap at $6\frac{1}{4}$ cents a bar.

8. 960 dozen of eggs at $\$.33\frac{1}{3}$ a dozen.

9. 32 yd. of dress goods at $\$.33\frac{1}{3}$ a yard.

10. 328 grammar school arithmetics at $\$.62\frac{1}{2}$ apiece.

11. 656 steel shovels at $\$.87\frac{1}{2}$ each.

12. What is the cost of 460 army horses at \$125 apiece?

13. At \$25 each what is the cost of 6 dozen dining tables?

Find the cost of:

14. 6 dozen cans of corn at $16\frac{2}{3}¢$ apiece.

15. 960 doz. eggs at $37\frac{1}{2}¢$ a dozen.

16. 3 gross base balls at $75¢$ each.

17. 1500 lb. honey at $25¢$ a pound.

18. 3164 lb. mixed bacon at $37\frac{1}{2}¢$ a pound.

19. 88 Victrolas at \$125 each.

Problems

1. How many pineapples will \$2 buy at the rate of $12\frac{1}{2}¢$ each?

2. When 3 lb. of butter are sold for \$1, what is the price per pound? How many pounds will \$5 buy?

3. How many yards of long cloth will \$10 buy at $33\frac{1}{3}¢$ a yard?

4. At $33\frac{1}{3}¢$ a yard, how many yards of linen can be bought for \$150?

5. When honey is $25¢$ a pound, how many pounds can be bought for \$640?

6. At $87\frac{1}{2}¢$ a bushel, how many bushels of oats can be purchased for \$100?

7. How many bushels of barley can be bought for \$624 at \$.75 a bushel?

8. At $\$.66\frac{2}{3}$ each, how many pocket knives can be purchased for \$64?

9. How many articles, at $14\frac{2}{7}$ cents each, can be purchased for \$154?

10. At $87\frac{1}{2}$ cents each, how many Christmas books can be bought for \$1456?

11. When peaches cost $87\frac{1}{2}¢$ per basket, how many baskets can be bought for \$140?

12. How many army mules at \$125 each can be bought for \$37,500?

13. At $\$12\frac{1}{2}$ each, how many rockers can be bought for \$400?

14. At $\$33\frac{1}{3}$ apiece, how many overcoats can a clothier purchase for \$1800?

15. At $12\frac{1}{2}¢$ a pound, what will 8 pounds of rice cost?

16. How many pounds of coffee at $33\frac{1}{3}¢$ a pound can be bought for a dollar?

17. Six grapefruit are bought for $1. What is the price of one?

18. Find the cost of 60 pounds of candy at $66\frac{2}{3}$ cents a pound.

19. At $87\frac{1}{2}¢$ a yard how many yards of cloth can be bought for $14?

20. How many bushels of grass seed at $\$16\frac{2}{3}$ a bushel can be bought for $100?

21. At $75¢$ each, what must be paid for 200 hens?

22. If a pair of shoes cost $\$4.37\frac{1}{2}$, what will two dozen pairs cost?

23. Three thousand, nine hundred sixty gallons of oil were sold at $16\frac{2}{3}¢$ a gallon. What was received for the oil?

24. A merchant bought 64 pounds of dried apples for $14. What was the price per pound?

25. At $\$6.62\frac{1}{2}$ a pair, how many pairs of rubber boots can be bought for $106?

26. My father bought pumps at $\$7.33\frac{1}{3}$ each. He sold them at $9 each. What did he gain on 6 dozen pumps?

27. A farmer sells onions for $2.75 a bushel and receives $242. How many bushels does he sell?

28. At $12.50 an acre, how many acres of land can be bought for $2400?

29. Mr. Jones paid $.33\frac{1}{3}$ of his debt with a $20 bill. What was the amount of his debt?

Short Processes

Much time may be saved by taking advantage of short cuts, one or more of which may be used in almost every problem. Some of the most helpful are given here.

To multiply an integer by 10 *or a power of* 10, *annex as many zeros to the integer as there are ciphers in the multiplier.*

Without a pencil, multiply :

34 by 10	401 by 10	3 by 10,000
65 by 100	230 by 10	70 by 100
30 by 1000	840 by 100	1600 by 10

1. How may decimals be multiplied by 10? By 100? By 1000? By 10,000?

2. *Multiply by* 10; by 100; by 1000:

61.23; 250; 3.1416; .27; 100; 2.31; 36.1724; 275.81.

3. *Multiply by* 100; by 1000; by 10,000:

29.235; 32.542; 21.003; 3.201; 2.5.

4. Multiply .0612 by 10,000; by 1,000,000.

5. What is the effect of adding one zero to an integer? Two zeros? Four zeros?

6. What is the effect of moving the decimal point one place to the right? One place to the left? Three places to the right?

7. *To multiply a number by* 25, *multiply it by* 100 *and divide the product by* 4; *e.g.*

$$39 \times 25 = 3900 \div 4 = 975.$$
$$(25 = 100 \div 4)$$

Without a pencil, multiply by 25:

12	40	9	7
16	80	.11	1.7
24	60	13	19
.08	.32	1.5	.28

8. *To multiply a number by* 125, *multiply it by* 1000 *and divide the product by* 8; *e.g.*

$$2.346 \times 125 = 2346 \div 8, \text{ or } 293.25.$$
$$(125 = 1000 \div 8)$$

Without a pencil, multiply by 125:

16	8	3.2	.4	.24	9

Using a pencil only when necessary, multiply by 125:

42	6.2	.429
70	.209	37.24
1.38	.91	.892
7.5	92.41	12.4
8.41	29.83	660

9. *To multiply a number by* 99, *multiply the number by* 100 *and subtract the multiplicand from that product; e.g.*

$$3.965 \times 99 = 396.5 - 3.965 = 392.535.$$
$$(99 = 100 - 1)$$

Using a pencil only when necessary, multiply by 99:

43	.824	3756	.248
72	3.86	92.36	99
6.45	4.98	.424	1.48

10. *To multiply by* $12\frac{1}{2}$, *multiply by* 100 *and divide the product by* 8; *e.g.*

$$47 \times 12\tfrac{1}{2} = 4700 \div 8 = 587.5.$$
$$(12\tfrac{1}{2} = 100 \div 8)$$

Using a pencil only when necessary, multiply by $12\frac{1}{2}$:

16	42	72	79
3.6	7.5	.324	8.3
.13	96	43	48

11. *To multiply a number by* $33\frac{1}{3}$, *multiply it by* 100 *and divide by* 3. Why?

Without a pencil, multiply by $33\frac{1}{3}$:

15	36	60	52	.66
12	48	7.5	1.8	420
21	5.4	102	31.2	969

12. *To multiply a number by* $16\frac{2}{3}$, *multiply it by* 100 *and divide by* 6. Why?

Without a pencil, multiply by $16\frac{2}{3}$:

42	6.6	9.6	30	.48	.72
84	54	7.8	180	.36	.90

13. *To multiply a number by* $14\frac{2}{7}$, *multiply it by* 100 *and divide by* 7. Why?

Without a pencil, multiply by $14\frac{2}{7}$:

4.2	840	1.05	.63	84.7	490
14	2.8	6.3	42	9.1	35

14. *To divide a number by* 50, *multiply it by* 2 *and point off two decimal places in the product.* Why?

Without a pencil, divide by 50:

13	18	63	39	9
27	29	75	65	11
46	40	48	81	7

Problems

1. Find the cost of 84 typewriters at $50 each.

2. What will 100 boxes of apples cost at $1.75 a box?

3. A man will husk how many bushels of corn in 25 days, at the rate of 60 bu. a day?

4. How much can a man earn in 32 months at the rate of $250 a month?

5. How far will a man drive his automobile in 16 days if he drives 125 miles a day?

6. What will 24 lb. of raisins cost at $12\frac{1}{2}¢$ a pound?

7. What will 99 acres of land cost at $75 an acre? $(100 \times 75 - 75.)$

8. 99 people went on an excursion that cost $5 a person. What was the entire expense? $(5 \times 100 - 5.)$

9. What will a boy earn in 48 hours' work at $25¢$ an hour?

10. A grocer bought a case of 24 dozen eggs at $33\frac{1}{3}¢$ a dozen. How much did he pay?

11. .25 of a man's money is invested in liberty bonds. If he has $20,000, how much is invested in liberty bonds?

12. Mr. Andrews earns $4200 a year. His rent costs $.14\frac{2}{7}$ of that sum. How much does he pay for rent?

13. Mr. Irving had 1200 bushels of apples; $.16\frac{2}{3}$ of them were not marketable. How many bushels were marketable?

14. How many melons at $\$.33\frac{1}{3}$ apiece can be bought for $5?

15. How many hours must Theodore work, at $50¢$ an hour, to earn $20?

Problems with Numbers Omitted

1. If a merchant buys goods for $—— and sells them at a loss of $——, what is the selling price?

2. A house is bought for $—— and sold at a gain of $——. Find the selling price.

3. Coal is bought at $—— a ton and sold at $—— a ton more than the cost. For what is the coal sold per ton?

4. A farm is sold for $—— at a gain of $——. What was the cost?

5. A block is —— rods long. How many feet long is it?

6. What must be paid for —— feet of fence at $—— a yard?

7. How many feet are there in —— miles?

8. Of —— barrels of apples in storage —— barrels spoil and —— barrels are sold. How many barrels remain?

9. How much will a merchant receive for —— bushels of peaches at —— cents a quart?

10. How many chairs at $—— each can be bought for $——?

11. Find the cost of —— gallons of molasses at —— cents a quart.

12. Mr. Kent spent $—— for hay at $—— a ton. How many tons did he buy?

13. Mr. Andrews bought —— bicycles at —— dollars each and sold them at —— dollars each. What was his profit on them?

14. At —— cents a gallon, how many gallons of gasoline will —— dollars buy?

Home Problem

Object: To find the cost of food for one person for

(*a*) one week, (*b*) one day, (*c*) one year.

Ask your mother to let you keep an account of all the expenses of the family for groceries, milk, and meat for one week. Use a form like this:

Name_____ Date_____

Day	No.	Article	Price per Lb., Etc.	Total Cost
Mon.				

Total cost for the week . . . . . $

How many persons are there in your family?

About how much was the average cost for the food for each member of the family for the week?

About how much was the average cost for each member of the family for one day?

At this rate find the cost of the food which you eat in a year of 365 days.

Exercise

There are five members in Fred's father's family. They use three quarts of milk each day. This milk costs twelve cents a quart. Their grocery and meat bills for a week were as follows:

Monday	1 loaf bread at 12¢
	1 pkg. 14X sugar at 10¢
	$5\frac{1}{4}$ lb. squash at 4¢ a lb.
	1 pkg. salt at 15¢
	3 lb. butter at 58¢ per lb.
	2 lb. meat at 22¢ per lb.
Tuesday	1 qt. salad dressing at 85¢ per qt.
	1 lb. nuts at 45¢ per lb.
	2 heads lettuce at 10¢ each
	1 bunch celery at 15¢
	1 pkg. grape nuts 18¢
Wednesday	1 loaf bread
	2 pkg. Uneeda Biscuit at 7¢ each
	1 peck potatoes at 45¢
	1 pkg. raisins at 15¢
	2 doz. eggs at 45¢ per doz.
	2 lb. rice at 12¢ per lb.
	$2\frac{3}{4}$ lb. meat at 36¢ per lb.
Thursday	$1\frac{1}{2}$ doz. rolls at 18¢ per doz.
	2 cans salmon at 35¢ each
	1 peck apples at 40¢
	2 pkg. shredded wheat at 12¢ each
	1 pkg. rolled oats at 30¢
	5 lb. sugar at $6\frac{1}{2}$¢ per lb.
Friday	$\frac{1}{2}$ doz. oranges at 90¢ per doz.
	2 lettuce
	1 bunch celery
	$2\frac{1}{4}$ lb. fish at 24¢ per lb.
	1 loaf bread

Saturday $4\frac{3}{8}$ pounds of lamb at 40¢ per lb.
1 loaf bread
6 lb. cabbage at 5¢ per lb.
1 can peas at 25¢
1 doz. bananas at 40¢
1 lb. coffee at 80¢

Find the total cost of the milk, meat, and groceries for this family for one week. At this rate, what would be the cost for the family for a year of 52 weeks? Find the average cost for one member of the family for one year.

Home Problem

Object: To find the cost of heat, light, water, and rent for your home for one year.

Fill out the following form:

Name_____ Date_____

Item	Cost per Month	Cost per Year
Furnace Coal		
Stove Coal		
Wood		
Gas		
Lights		
Water		
Rent		
Total		

How many tons of coal are burned in the furnace in your home in one year?

What is the cost of this coal per ton?

How many tons of coal are used in the kitchen stove during the year?

What does this coal cost per ton?

How many cords of wood are burned in the fireplace, stove and furnace during the year?

What is the cost of the wood per cord?

How much is paid each month for gas?

What is paid per month for rent? For water?

How many persons are there in your family?

About how much does it cost for each person per year for heat, light, water and rent?

Exercise

There are six persons in Mr. Allen's family. Mr. Allen finds that it takes 8 tons of furnace coal at $13.50 per ton, 4 tons of pea coal for the kitchen stove at $11.75 a ton and two cords of wood at $4.60 a cord to heat the house for a year.

The gas bills are as follows: Jan. $2.30; Feb. $1.90; Mar. $2.80; April $3.10; May $3.60; June $2.90; July $1.00; August $1.50; Sept. $2.30; Oct. $3.10; Nov. $2.40; Dec. $2.70.

The electric light bills are as follows: Jan. $5.10; Feb. $4.95; March $5.35; April $3.95; May $2.85; June $1.95; July $1.00; August $1.00; Sept. $1.85; Oct. $2.65; Nov. $4.80; Dec. $6.75.

Mr. Allen pays $50 per month rent. He pays his water bill quarterly as follows: Jan. $4.00; April $4.10; July $5.60; Oct. $6.80.

Find the total cost of fuel, light, water and rent for Mr. Allen's family for one year. Find the average cost per month. Find the average cost for each member of the family for one year.

Mental Tests

1

1. Write 649 in Roman.
2. Write four million, nine thousand, seven.
3. Write 3214 ten-thousandths.
4. Write 59 cents 4 mills.
5. $59 + 10 + 9 + 3 + 7 + 12 = ?$
6. $92 - 7 - 5 - 12 - 9 - 6 - 4 = ?$
7. $9 \times 12 = ?$
8. $132 \div 12 = ?$
9. $7 \times 9 = ?$
10. $96 \div 8 = ?$

2

1. Divide 956.3 by 100.
2. .50 of 200 = ?
3. .75 of ? = 300.
4. Multiply 869 by 100.
5. Multiply 21 by $33\frac{1}{3}$.
6. Divide 1269.8 by 1000.
7. $.25 \times ? = 50$.
8. ? part of 36 is 6?
9. Multiply 25 by 24.
10. Multiply 50 by 206.

3

1. Find the prime factors of 45.
2. What is the G. C. D. of 6 and 9?
3. What is the L. C. M. of 6 and 8?
4. Change $\frac{2}{3}$ to ninths.
5. Reduce $\frac{15}{18}$ to lowest terms.
6. Reduce 8 to 8ths.
7. Change $3\frac{3}{5}$ to an improper fraction.
8. Reduce $\frac{10}{3}$ to a mixed number.
9. Change .75 to a common fraction in lowest terms.
10. Find $\frac{3}{4}$ of 20.

4

1. What part of 30 is 6?
2. $\frac{2}{3}$ of what = 10?
3. Reduce 2 yd. 2 ft. to feet.
4. Change 3 ft. 4 in. to inches.
5. Change 60 inches to feet.
6. Reduce 18 sq. ft. to square yards.
7. 72 sq. in. is what part of a square foot?
8. How many square inches are there in $\frac{1}{4}$ a square foot?
9. What is the area of a rectangle 12 ft. by 10 ft.?
10. How many inches are there in a foot?

5

1. Write 1385 cents as dollars and cents.
2. How many quarts are there in 40 pints?
3. Change 80 quarts to gallons.
4. What decimal part of a bushel is a peck?
5. Change 64 quarts to pecks.
6. Reduce 3 T. 2 cwt. to hundredweight.
7. Change 32 ounces to pounds.
8. How many minutes are there in $1\frac{1}{2}$ hours?
9. How many inches are there in $\frac{1}{2}$ of a yard?
10. 9 is what part of a dozen?

6

1. Find $\frac{1}{6}$ of 60.
2. Find $\frac{7}{10}$ of 20.
3. What is .10 of 200?
4. What is $\frac{1}{3}$ of 90?
5. How many buttons are there in $\frac{1}{4}$ of a gross?
6. What will 500 ft. of lumber cost at $40 per M?
7. What will 18 eggs cost at 50¢ per doz.?
8. Add $\frac{1}{2}$ and $\frac{1}{4}$.
9. Change $.66\frac{2}{3}$ to a common fraction.
10. How many pints are there in $\frac{3}{8}$ of a gallon?

7

1. Change $\frac{1}{4}$ to a decimal.
2. $\frac{1}{3} + \frac{1}{2} = ?$
3. Change $\frac{20}{100}$ to a fraction.
4. $2\frac{1}{2}$ ft. = how many inches?
5. How many bolts are there in $\frac{3}{4}$ of a gross?
6. Reduce 3 bu. 1 pk. to pecks.
7. Find the cost of 200 ft. of lumber at $50 per M.
8. If $10 will buy 5 books, how many can you buy for $12?
9. Add $\frac{1}{2}$ and $\frac{3}{4}$.
10. Subtract $\frac{1}{8}$ from $\frac{3}{4}$.

8

1. Change 3 gal. to pints.
2. 1 mi. = how many feet?
3. Find .05 of 200.
4. Change 32 pt. to gallons.
5. Find $\frac{2}{5}$ of $800.
6. $\frac{1}{8} + \frac{3}{8} = ?$
7. Change .150 to a fraction.

8. Subtract $\frac{3}{4}$ from $1\frac{1}{4}$.
9. At \$30 per M, find the cost of 1500 ft. of lumber.
10. What will $\frac{3}{4}$ of a yard of cloth cost at \$1 per yard?

9

1. From \$10 take $\$6\frac{1}{4}$.
2. .20 of a ton = ? lb.
3. Find .25 of 100.
4. $\frac{1}{4}$ mi. = how many rods?
5. $\frac{1}{8}$ A. = how many square rods?
6. Change $2\frac{1}{2}$ lb. to ounces.
7. What will 10,000 shingles cost at \$4 per M?
8. How many square feet are there in a rug 9 ft. by 12 ft.?
9. At 9¢ per lb., what will 2 cwt. of flour cost?
10. Subtract $\frac{5}{8}$ from $1\frac{1}{8}$.

10

1. Write 1918 in Roman numerals.
2. $\frac{1}{12}$ of 144 = ?
3. $\frac{3}{4}$ hr. = how many minutes?
4. $3\frac{1}{4} \div 13$ = ?
5. .06 of \$600 = ?
6. Change 4 lb. to ounces.
7. What is .5 of 5?
8. .6 of \$60 = ?
9. $\frac{1}{4}$ of .8 = ?
10. $\frac{1}{4}$ gal. = ? gills.

11

1. Change $\frac{11}{20}$ to hundredths.
2. Write \$796 in words.
3. What are the prime factors of 81?
4. If two eggs cost 8¢, what will $1\frac{1}{2}$ doz. cost?
5. 18 is .50 of what number?
6. How many pounds are there in .2 of a ton?
7. If .3 of Roy's money is \$300, how much has he?
8. 12 is what decimal part of 16?
9. .55 of \$1000 = ?
10. .875 of \$1000 = ?

12

1. What will 3 pk. of apples cost at \$1.60 per bushel?
2. Find the cost of $2\frac{1}{4}$ lb. of rice at 12¢ per lb.
3. From Jan. 1 to Nov. 1 is how many months?
4. 24 is .25 of what number?
5. .4 of \$600 = ?
6. What are the prime factors of 70?
7. Write \$1049 in words.
8. If one yard of cloth costs 75¢, how many yards can be bought for \$4?

9. At 3¢ per mile, what will it cost to travel 31 miles?
10. At 20¢ per cwt., what will it cost to ship 1 T. of feed?

13

1. Hay at $20 per T. brings $50. How many tons are sold?
2. Find .4 of $400.
3. Write $938 in words.
4. What change should be received from $2.00 when a purchase of $1.43 is made?
5. A jar of butter weighing $10\frac{1}{2}$ pounds is sold for $5.25. What is the price per pound?
6. At $8 per ton, what will 1000 pounds of coal cost?
7. Change $8\frac{1}{3}$ feet to inches.
8. What is .40 of $120?
9. Write $\frac{3}{8}$ as hundredths.
10. Find .03 of $400.

14

1. Find the cost of 40 yards of cloth at $.50 a yard.
2. Add $.87 and $5.03.
3. Divide 9 by .9.
4. Subtract $\frac{3}{5}$ from 2.
5. Multiply $\frac{1}{2}$ by 3.
6. What must be added to $5\frac{1}{2}$ to make $6\frac{3}{4}$?
7. How many balls at 25 cents each can be bought for $5?
8. What is $\frac{1}{2}$ of $\frac{1}{2}$?
9. Change 90 to tenths.
10. What part of 1000 is 10?

15

1. How many bushels of beets at one dollar per bushel can be bought for $12\frac{1}{2}$?
2. What is $\frac{1}{4}$ of $\frac{1}{2}$?
3. Change $9\frac{1}{2}$ to 4ths.
4. Find the cost of 4000 feet of hemlock at $40 per M.
5. What fraction must be added to $\frac{3}{5}$ to make $\frac{9}{10}$?
7. What part of $\frac{1}{2}$ is $\frac{1}{4}$?
8. Write $\frac{7}{8}$ as a decimal.
9. Write .125 as a fraction in lowest terms.
10. Change $\frac{2}{3}$ of a yard to inches.

16

1. What must be paid for 8000 brick at $38 per M?
2. Change $\frac{3}{4}$ of a gallon to pints.
3. Subtract $\frac{3}{8}$ from $\frac{3}{4}$.
4. Write .375 as a fraction in lowest terms.
5. Find the cost of 11,000 shingles at $5 per M.
6. Divide five by such a number that the quotient is one.
7. What part of $\frac{3}{4}$ is $\frac{1}{4}$?
8. Divide 100 by .5.
9. Multiply $\frac{3}{5}$ by $\frac{5}{8}$.
10. Divide $\frac{3}{4}$ by $\frac{3}{8}$.

17

1. Divide six by such a number that the quotient is two.
2. What part of $\frac{7}{8}$ is $\frac{1}{8}$?
3. Divide 100 by .25.
4. Find the cost of 100 square yards of walk at $.30 cents per sq. yd.
5. Subtract .25 from .5.
6. .05 times 200 = ?
7. Find the cost of 36 yards of cloth at $.75 per yard.
8. Change $2\frac{1}{2}$ bushels to pecks.
9. Write 235 in Roman.
10. Six inches is what fractional part of a yard?

18

1. Divide 7 by such a number that the quotient is 14.
2. Find the cost of 12 gallons of gasolene at $.25 per gallon.
3. Subtract .3 from .75.
4. Add $\frac{3}{4}$ and .75.
5. Divide $\frac{9}{16}$ by $\frac{3}{16}$.
6. Subtract $\frac{7}{16}$ from $\frac{5}{8}$.
7. Find the cost of 80 posts at .75 each.
8. What must be paid for 144 bars of soap at 50¢ a dozen?
9. Change 80,000 pounds to tons.
10. A city lot costing $900 is sold for $1050. What was the gain?

19

1. Five is what decimal part of 25?
2. Find the cost of 8 quarts of oats at one dollar per bushel.
3. Three tenths is what fractional part of nine tenths?
4. Subtract seven hundredths from three tenths.
5. A barrel contains 27 gallons of oil. How many two-quart cans can be filled from the barrel?
6. $\frac{7}{12} \div \frac{1}{6} = ?$
7. $\frac{3}{5} + \frac{1}{3} = ?$
8. $1\frac{1}{12} - \frac{3}{4} = ?$
9. $11 \times \frac{5}{22} = ?$
10. Find the cost of 40,000 pounds of lime at $4 per ton.

20

1. Change 565 cents to dollars and cents.
2. Write CCXXXIX in Arabic.
3. Twenty gallons of cream are put up in half-pint bottles. How many bottles are required?
4. What must be subtracted from $19\frac{1}{2}$ to leave $15\frac{1}{4}$?
5. Divide $2\frac{1}{2}$ dollars equally among ten boys. How much will each receive?
6. The circulation of our library was 8500 for February and 9600 for March. What was the gain in circulation?
7. Find $\frac{4}{7}$ of 14.
8. Divide 14 by $\frac{7}{4}$.
9. What part of 16 is $\frac{1}{2}$?
10. What part of 14 is 7?

21

1. Change $\$13\frac{3}{4}$ to cents.
2. Four rods equals how many feet?
3. Divide 25 by $\frac{5}{6}$.
4. Multiply 25 by $\frac{6}{5}$.
5. Add $\frac{3}{8}$, $\frac{5}{8}$, $\frac{1}{4}$, $\frac{3}{4}$, and $\frac{1}{7}$.
6. Subtract $\frac{3}{10}$ from $\frac{2}{5}$.
7. Find the cost of 720 bulbs at $33\frac{1}{3}$¢ a dozen.
8. Find the cost of 8000 feet of pine at $60 per M.
9. Change $2\frac{1}{2}$ bushels to quarts.
10. A coat costing $20 is sold so as to gain $\frac{1}{2}$ the cost. What was the gain?

22

1. Goods costing \$10 are sold so as to gain $\frac{1}{2}$ of the cost. What was the selling price?
2. At 3 for 25¢, what will one grapefruit cost?
3. Change 12 feet to inches.
4. Subtract .7 from 2.
5. $\frac{1}{2} \times ? = 8$.
6. What part of 5 is 3?
7. Add 9, 11, 8, and 12.
8. Subtract 39 from 68.
9. Divide 4.5 by .9.
10. Multiply 5.1 by 20.

23

1. A car costing \$600 was sold so as to gain $\frac{1}{3}$ of the cost. What was the selling price?
2. Divide 7.5 by 2.5.
3. Change 400 quarts to gallons.
4. Subtract .9 from 3.
5. $\frac{1}{5} \times ? = 10$.
6. What part of 8 is 5?
7. Divide 100 by $33\frac{1}{3}$.
8. Divide 6.3 by .7.
9. Multiply 2.5 by 80.
10. Add $13\frac{1}{4}$, $6\frac{3}{4}$, $6\frac{1}{2}$, and $13\frac{1}{2}$.

24

1. Divide 9.9 by 3.3.
2. Add 21, 24, 23, and 25.
3. $\frac{1}{6} \times ? = 2$.
4. Multiply 12.5 by 20.
5. Find the cost of 450 pounds of sugar at \$6 per hundred.
6. A coat costing \$25 was sold so as to gain $\frac{2}{5}$ of the cost. What was the selling price?
7. What part of .9 is .3?
8. Divide 100 by $12\frac{1}{2}$.
9. Subtract 1.5 from 4.
10. Change 160 ounces to pounds.

Tests of Accomplishment

1

1. Add 920,213
   734,578
   51,832
   838,364
   298,999
2. 635,773 − 267,694 = ?
3. 4397 × 798 = ?
4. 2474 ÷ 7 = ?
5. 510,102 ÷ 51 = ?

2

1. Add 635,773
   176,889
   272,965
   994,697
   869,548
2. 580,706 − 359,817 = ?
3. 90,576 × 609 = ?
4. 828,657 ÷ 9 = ?
5. 460,756 ÷ 907 = ?

3

1. Divide 12 by .03.
2. Multiply 16.9 by 7.71.
3. Divide 18.36 by .6.
4. 59.63 ÷ 1000 = ?
5. .7 of ? = 4.9.

4

1. Divide 5.425 by .7.
2. Multiply 9.07 by 50.8.
3. Divide 10.83 by 5.7.
4. Subtract .29 from 2.
5. What number times 12 = 1.44?

5

1. $\dfrac{81 \times 63 \times 60}{35 \times 72 \times 96} = ?$

2. When 10 city lots cost $12,000, what will 14 lots cost at the same rate? Solve by cancellation.

3. Find the G. C. D. of (*a*) 60 and 96; (*b*) 44, 66, and 99.

4. Find the L. C. M. of (*a*) 16, 20, and 24; (*b*) 14, 21, and 49.

5. Reduce $\frac{88}{165}$ to lowest terms.

6

1. Change $\frac{5}{8}$ to 64ths.
2. Reduce $21\frac{2}{7}$ to an improper fraction.
3. Reduce $\frac{84}{9}$ to a mixed number.
4. Change .625 to a common fraction in simplest form.
5. Reduce $8\frac{3}{5}$ to a mixed decimal.
6. Add $\frac{3}{5}$ and $\frac{7}{20}$.
7. Add $5\frac{2}{5}$, $6\frac{1}{3}$, $1\frac{8}{15}$.
8. Subtract $\frac{3}{7}$ from $\frac{9}{14}$.
9. Subtract $23\frac{5}{6}$ from $29\frac{11}{12}$.
10. $30\frac{4}{9} - 21\frac{11}{18} = ?$

7

1. $\frac{4}{5}$ of $18 = ?$
2. $\frac{8}{11} \times \frac{55}{24} = ?$
3. $8\frac{3}{11} \times 77 = ?$
4. $5 \div \frac{5}{7} = ?$
5. $\frac{3}{4}$ of $44 = ?$
6. $\frac{5}{9} \times 19 = ?$
7. $3\frac{2}{7} \times 2\frac{3}{5} = ?$
8. $\frac{18}{25} \div \frac{5}{9} = ?$
9. $6\frac{5}{12} \div \frac{11}{24} = ?$
10. ? (part) of 36 is 9?

8

Reduce:

1. .75 ft. to inches.
2. 1.5 rd. to feet.
3. .375 mi. to rods.
4. .625 lb. to ounces.
5. .25 A. to square rods.
6. 14 sq. ft. and 130 sq. in. to square inches.
7. 7 sq. yd. and 6 sq. ft. to square feet.
8. Change 6000 pounds to tons.
9. Find the number of square inches in a rectangle 14 inches by 11 inches.
10. 2 bu. 3 pk. 7 qt. to quarts.

SIXTH GRADE — SECOND HALF

BILLS

The person who sells the goods is the **creditor**, *and the purchaser is the* **debtor**. *The debtor and creditor are called* **parties** *to the account.*

Dr. stands for debtor, and Cr. for creditor.

At certain times, the creditor copies on a sheet of paper a statement of the debtor's account and sends it to the debtor. *This statement is called* a **bill.**

A bill should always contain these things:

1. The time and place of making out the bill. This is called the date of the bill.
2. The debtor's name and address.
3. The creditor's name and address.
4. A list of the items — that is, the goods sold, money paid, or services rendered, — with the amount of each item.
5. The date of each transaction.
6. The amount, or footing, of the bill.

1. *Syracuse, N. Y.*
January 31, 1925.

2. *Mr. James A. Shea,*
1904 James St.,

3. *To Dey Brothers Co., Dr.*

4. *Jan.*	*2*	*1 pair shoes*		*9*	*00*	
5.	*5*	*1 refrigerator*		*64*	*00*	
	7	*3 pair hose*	*@ 1.00*	*3*	*00*	
6.						*76* *00*

(Form 1)

BINGHAMTON, N. Y., June 20, 1926.

MR. JAMES E. DOLAN,
713 Main St.,

Bought of BROWN BROTHERS,
Court and Warren

	2 bu. Apples	$1.10	$2	20		
	10 lb. Granulated Sugar	.07½		75		
	½ lb. Tea	.50		25	$3	20

Read the items of this bill.
Who is the creditor? The debtor?
What is the amount of the bill?
Who ought to pay the bill?
Who should receive the money?

(Form 2)

SPOKANE, WASH.
April 1, 1926.

MR. W. C. FLINT,
1213 Maxwell Ave.,

To CARROLL SMITH, M.D., *Dr.*
Old National Bank Building.

To professional services rendered, Feb. 25 to March 18, 1926,	$37	50
Received Payment, April 16, 1926. CARROLL SMITH.		

Name each of the parties in this bill. Has the bill been paid? How do you know?

Make out bills of the following items, the teacher being the debtor, and yourself the creditor. Receipt the bill.

8 lb. lard @ 19¢, means at 19¢ a pound.
3 doz. articles @ 33⅓¢, means at 33⅓¢ a dozen.
½ lb. tea @ 50¢, means at 50¢ a pound.

1. 3 bu. potatoes at $1.25 per bushel.
   8 lb. lard at 19¢ per pound.
   5 gal. kerosene oil at 18¢ per gallon.

2. 4 lb. coffee at 35¢ per pound.
   18 lb. sugar at 7½¢ per pound.
   5 gal. molasses at 90¢ per gallon.

3. 6 bbl. potatoes at $3.80 per barrel.
   2 tons hay at $16 per ton.
   3 cords wood at $8 per cord.

4. 6 size 5′ by 8′ U. S. Flags style " Defiance " at $4.50 each.
   2 size 8′ by 12′ U. S. Flags style " Defiance " at $9.00 each.
   3 size 10′ by 15′ U. S. Flags style " Defiance " at $14.50 each.

5. 2 doz. cabbage at 10¢ each.
   2½ bu. potatoes at 80¢ per bushel.
   3 bu. apples at $1.25 per bushel.
   4¾ lb. chicken at 40¢ per pound.

6. Mr. Victor Holl worked 44 hours as a carpenter at 95¢ per hour for Mr. J. H. Brown. Make out Mr. Holl's bill. Receipt this bill as if it was paid last Monday.

7. Dr. Sidney Britten performed an operation on James Fammin's throat. Make out the bill when the doctor charged $65 for his services.

8. Fill out a statement of J. B. Cook's account for the following: 2 umbrellas at \$2.15; 1 pair gaiters at \$5.50; 11 yd. gingham at 75¢; $\frac{1}{4}$ doz. silk hose \$18. Supply the place and the dates. Foot and receipt as clerk of Dey Bros. & Co.

9. Peter Fox, farmer, sold J. D. Price the following:

18 bu. potatoes @ 98¢; 5 bu. carrots @ 85¢; $4\frac{1}{4}$ doz. eggs @ 48¢; 10 bu. apples @ \$1.50. Make the bill. Foot and receipt it.

10. The pupil as debtor, the teacher as creditor, foot and receipt the following:

66 yd. carpet @ \$1.66$\frac{2}{3}$; 1 Royal Wilton rug @ \$68; 3 pr. Madras curtains @ \$4.33$\frac{1}{3}$; 4 window shades @ \$1.87$\frac{1}{2}$.

Make out bills for the following. Supply names and dates. Foot and receipt them. Supply the prices:

11. 18 yd. silk @ —.
6 yd. Irish linen @ —.
4 pr. hose @ —.
1 cane seat rocker.

12. 15 bbl. flour @ —.
45 lb. ham @ —.
25 sacks flour @ —.
84 lb. butter @ —.

13. 4 lb. of coffee @ —.
18 lb. sugar @ —.
4 gal. molasses @ —.
16 lb. rice @ —.

14. 2 lb. pork steak @ —.
3 lb. veal cutlet @ —.
2 boxes strawberries @ —
3 doz. eggs @ —.

15. 2 lb. tea @ —.
5 lb. lard @ —.
5 lb. sugar @ —.
3 lb. raisins @ —.

16. 5 lb. nails @ —.
4 pr. hinges @ —.
3 doz. screws @ —.
2 lb. putty @ —.

Receipts

A **receipt** *is a statement showing the payment of a bill.*
A receipt should contain these parts:

1. The place and date.
2. The name of the debtor.
3. The amount paid stated both in words and in figures.
4. For what the receipt is given.
5. The signature of the creditor or his agent.

$52.00 *Rochester, N. Y., Feb. 4, 1925*

Received from *Frederick Smith*

Fifty-two $\frac{00}{100}$ *Dollars*

January purchases

L. A. Witherill, Inc.
J. D. Brown

Ask your father to let you see some old checks which he has had returned by his bank. These checks should always be kept. Can you tell why? State why it is a good plan for your father to place his money in the bank and pay his bills by check.

If a bill is marked paid it also acts as a receipt. When a bill is paid by the use of cash, how should it always be marked?

Write a receipt for $3.60 received by you from your teacher for a subscription to a newspaper.

Home Problem

John's father makes him an expense allowance of $4.00 a month. John earns various other amounts during the month. It is to his advantage to keep a record of what he receives and what he spends so that he may know at the end of the month just how much he should have to deposit in his Savings Bank Account.

This is the way John kept his account.

Receipts				Expenditures			
1925				1925			
Feb.	1	Allowance	4 00	Feb.	1	Class dues	25
	2	Taking out ashes	50		1	Carfare	14
	7	Running errand	10		4	Tablet	15
	10	Helping Mother	25		5	Concert	50
	18	Cleaned Car	50		15	Movies	25
	24	4 hr. work	1 00		18	Collar	20
	26	Sold magazines	75		21	Skates	3 50
					24	Pencils	15
					27	Excursion	1 25
					28	Balance	71
			7 10				7 10

John's account shows that he has saved $.71. John should have that amount to place in the bank.

1. Rule your paper and keep your own account for a week, entering in it all you received and all you spent.

2. Suppose you are treasurer of a baseball club. Make out your account, showing money received from a Saturday exhibition, from gifts, and the amount on hand when you were elected. Show expenditures for suits, bats, and balls.

DENOMINATE NUMBERS

In early times measures were crude. The weight of men and animals was compared with that of a stone; the weight of jewels with that of a grain of wheat; short lengths with the length of a foot or the breadth of a hand; distances by a certain number of paces or steps, etc. As civilization advanced definite **units of measure** were established, first by custom and later by law. Size, weight, quantity, etc., are determined and expressed by these units. Units for measuring large quantities are multiples of those for measuring small amounts; for example, long distances are expressed in miles, while short lengths are expressed in yards or feet or inches. Sometimes quantities are expressed partly in large units and partly in smaller related units, as 4 pounds 8 ounces; 2 feet 10 inches; 8 gallons 2 quarts, etc.

A unit of measure is called a **denomination.**

Example : foot, yard, inch, ounce, pound, second.

A **denominate number** is a number that expresses measure.

Example : 6 ft.; 2 hr.; 5 lb.

A **compound number** is a number expressed in two or more denominations.

Example: 4 ft. 6 in.; 3 lb. 8 oz.; 2 hr. 30 min.

Clear ideas of the various units of measure can be obtained only by using them.

Denominate numbers are *reduced* from one denomination to another; for example, we may *reduce* 2 feet to 24 inches or 24 inches to 2 feet.

Reduction is changing the form of a number without changing its value.

Reduction

Reduction of a denominate number to a smaller unit is **reduction descending.** Reduction descending employs *multiplication.*

Reduction of a denominate number to a larger unit is **reduction ascending.** Reduction ascending employs *division.*

Linear Measure

Linear measures are so called because they are used in measuring lines. A line has but one dimension, viz. length.

Table of Linear Measure

12 inches (in.)	= 1 foot (ft.)
3 feet	= 1 yard (yd.)
$5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet	= 1 rod (rd.)
320 rods	= 1 mile (mi.)

1. How many inches are there in 1 yd.? In 10 yd.?

2. 10 rods are how many feet?

3. How many rods are there in the perimeter of a lawn that is 33 feet square?

4. Draw on the blackboard a line 1 yd. long, using no measure. Measure and correct it. On your paper draw a line $3\frac{1}{2}$ in. long, using no measure. Measure and correct it.

5. Estimate the length and breadth of your schoolroom. Test your estimates by measuring.

6. If you go 30 inches at a step, how many steps will you take in going 30 feet?

7. A row of corn contains five hills to a rod. How many hills are there in a row a quarter of a mile long?

8. How many feet does a boy run in a 100-yard dash?

9. Henry's record in a running high jump was 4 ft. 11 in. How many inches was it?

10. Estimate the distance from your home to the school.

Reduce:

11. 16 ft. to inches.
12. 75 yd. to feet.
13. 44 rd. to yards.
14. 320 rd. to feet.
15. 15 mi. to rods.
16. $8\frac{1}{4}$ mi. to rods.
17. $12\frac{1}{2}$ ft. to inches.
18. 40 rd. to yards.
19. 10 rd. to feet.
20. 50 mi. to rods.
21. $4\frac{2}{3}$ yd. to feet.
22. $2\frac{1}{3}$ rd. to yards.
23. $2\frac{1}{3}$ rd. to feet.
24. $5\frac{3}{4}$ mi. to rods.
25. 50 rd. to yards.
26. 30 rd. to yards.

27. Reduce 4 yd. 2 ft. 6 in. to inches.

$$\begin{aligned} 4 \text{ yd.} &= 12 \text{ ft.} \\ 12 \text{ ft.} + 2 \text{ ft.} &= 14 \text{ ft.} \\ 14 \text{ ft.} &= 168 \text{ in.} \\ 168 \text{ in.} + 6 \text{ in.} &= 174 \text{ in.} \end{aligned}$$

Reduce to lower denominations:

28. 6 yd. 2 ft.
29. 14 yd. 2 ft.
30. 84 ft. 9 in.
31. 10 yd. 8 in.
32. 5 yd. 2 in.
33. 7 yd. 2 ft.
34. 4 rd. 2 ft.
35. 10 rd. 10 ft.
36. 6 rd. 8 ft.

6 ft. 4 in. is sometimes written 6′ 4″.

Reduce 8 ft. to inches.

1 ft. = 12 inches.
8 ft. = 8 × 12 in. or 96 in.

Reduce:

37. 48′ 8″ to inches.

38. 7′ 5″ to inches.

39. 4 yd. 2 ft. to feet.

40. 32′ 11″ to inches.

41. 18 rd. 4 yd. to yards.

42. 2 mi. 25 rd. to rods.

43. Reduce 177 inches to higher denominations.

177 in. = 14 ft. 9 in.
14 ft. = 4 yd. 2 ft.
4 yd. 2 ft. 9 in. *Ans.*

Reduce to higher denominations:

44. 17 in.; 158 in.; 141 in.; 162 in.

45. How many feet and inches in 265 in.?

46. How many miles and rods in 750 rd.?

47. Reduce 66 yd. to rods.

48. Change 150 inches to feet and inches.

49. Change 326 ft. to yards and feet.

50. Change 190 inches to feet and inches.

51. Change 360 ft. to yards.

52. Change 600 in. to feet.

1. Reduce 18 yd. 2 ft. to feet.

$$\begin{array}{r} 18 \\ \times\ 3 \\ \hline 54 \\ +\ 2 \\ \hline 56 \end{array}$$

The number of feet in 18 yards is the product of 18 and 3 or 54. There are 54 ft in 18 yd.
54 ft. + 2 ft. = 56 ft.
18 yd. 2 ft. = 56 ft.

2. Reduce $\frac{3}{8}$ mi. to rods. ($\frac{3}{8}$ of 320 rd. = ?)

3. Reduce .75 ft. to inches. (.75 of 12 in. = ? or $\frac{3}{4}$ of 12 in. = ?)

4. Reduce $\frac{1}{8}$ mi. to feet.

5. Reduce .875 yd. to inches. (.875 of 36 in. = 31.5 in. or $\frac{7}{8}$ of 36 in. = 31.5 in.)

Reduce :

6. 40 ft. to inches

7. 17 yd. 2 ft. to inches

8. 16 rd. to yards

9. 16 rd. to feet

10. 5.75 mi. to rods

11. $\frac{5}{8}$ mi. to rods

12. .125 mi. to rods

13. 1 mi. to yards

14. 4 rd. to feet

15. 1.14 rd. to feet

16. 5.25 yd. to inches

17. .6 mi. to rods

18. 38 rd. 9 ft. to feet

19. $\frac{1}{3}$ rd. to inches

20. A boy goes 2 feet at every step. How many steps will he take in walking $\frac{1}{2}$ mile?

21. How many feet are there in .375 mile?

22. How many yards long is a 1-mile running track?

23. How many feet does a boy run in a 70-yd. dash?

24. In the running broad jump a 95-lb. boy jumped 15 ft. 8 in. How many inches did he jump?

25. A square city block is $\frac{1}{8}$ mi. on one side. How many times must a boy run around it to run a mile?

Reduce to inches:

1. 4 ft.
2. 6 ft. 2 in.
3. 1 yd.
4. 1 yd. 1 ft.
5. 12 ft.
6. 10′ 9″
7. $\frac{3}{4}$ ft.
8. $\frac{2}{3}$ yd.

Reduce to feet:

9. 15 yd.
10. $5\frac{2}{3}$ yd.
11. 8 yd. 2 ft.
12. $\frac{1}{2}$ yd.

Reduce to rods:

13. 2 mi.
14. $\frac{1}{2}$ mi.
15. $1\frac{1}{4}$ mi.
16. 10 mi.
17. $\frac{1}{10}$ mi.
18. $\frac{1}{20}$ mi.
19. $\frac{1}{8}$ mi.
20. 5 mi.

Reduce:

21. 15 ft. to yards.
22. 11 yd. to rods.
23. 31 ft. to yards.
24. 480 in. to feet.
25. 640 rd. to miles.
26. 2 ft. to yards.
27. 160 rd. to miles.
28. 9 in. to feet.
29. 27 in. to feet and inches.
30. 17 ft. to yards and feet.

31. When a boy runs 60 yards how many feet does he run?

32. A boy made a record of 20 ft. in a running broad jump. How many inches did he jump?

33. Reduce to higher units: 102 ft.; 10.5 ft.

34. Reduce to feet: 1 mi. 2 rd.

35. Reduce $\frac{3}{4}$ mi. to feet.

36. Reduce 66 in. to feet.

37. Reduce to rods: 2.875 mi.; $5\frac{3}{4}$ mi.

38. Reduce to miles: 960 rd.; 1280 rd.

39. Reduce to inches: 45.75 ft.; $76\frac{1}{2}$ ft.

40. Reduce $\frac{8}{3}$ yd. to feet.

Express:

41. 5280 yd. in miles.
42. $\frac{3}{10}$ mi. in feet.
43. 3.6 mi. in feet.
44. $7\frac{1}{9}$ yd. in inches.

Surface Measure

144 square inches (sq. in.)	= 1 square foot (sq. ft.)
9 square feet	= 1 square yard (sq. yd.)
$30\frac{1}{4}$ square yards	= 1 square rod (sq. rd.)
160 square rods	= 1 acre (A.)
640 acres	= 1 square mile (sq. mi.)

In the practical uses of surface measure, no reductions of more than one step are required. The reductions most used are: (*a*) those involving square yards and square feet, and (*b*) those involving acres and square rods.

Pupils should do much estimating and measuring of surfaces.

1. Without a measure draw a square inch. Measure and correct it.

2. Without a measure draw on the blackboard a square foot and a square yard. Measure and correct them. Divide the square yard into square feet. Divide the square foot into square inches.

3. How many square inches are there in two square feet?

4. Estimate the number of square yards in the floor of your schoolroom. Measure it, and see how nearly right your estimate is. Make an estimate of the area of each wall, and test it by measuring. Measure your school lot, and find what part of an acre it contains.

5. How many square inches are there in $\frac{1}{2}$ sq. ft.?

6. A 5-inch square contains how many square inches?

Reduce:

1. 12 sq. ft. to square inches.
2. 11 sq. ft. to square inches.
3. 16 sq. yd. to square feet.
4. 40 A. to square rods.
5. $5\frac{3}{8}$ A. to square rods.
6. 20.1 sq. mi. to acres.
7. 13 sq. ft. 135 sq. in. to square inches.
8. 19 A. 80 sq. rd. to square rods.
9. 15 sq. yd. 7 sq. ft. to square feet.
10. 21 sq. mi. 40 A. to acres.
11. 1152 sq. in. to square feet.
12. 363 sq. yd. to square rods.
13. 99 sq. ft. to square yards.
14. 1920 sq. rd. to acres.
15. 3840 sq. rd. to acres.
16. 60.5 sq. yd. to square rods.
17. 80 sq. ft. to square yards and square feet.
18. 7200 sq. in. to square feet.
19. 490 sq. rd. to acres and square rods.
20. 970 sq. yd. to square rods and square yards.
21. $8\frac{3}{8}$ sq. mi. to acres.
22. A square mile is called a *section*. How many sections of land are there in 6400 acres?
23. What part of a square foot is 72 sq. in.?
24. How many square inches are there in $\frac{1}{4}$ of a sq. ft.?
25. In $\frac{5}{9}$ sq. yd. there are how many square feet?
26. What part of a square yard is 6 sq. ft.?

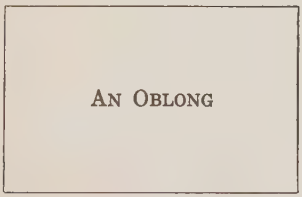
27. In $5\frac{3}{8}$ acres there are how many square rods?

28. If the ceiling of your schoolroom contains 810 sq. ft., how much will it cost to have it painted at 45¢ a square yard?

29. What will it cost to paint a surface measuring 150 sq. yd. at 5¢ a square foot?

When two lines meet so as to make a "square corner," they form a **right angle.** This is a right angle: ⌐

RECTANGLES



1. How many right angles has the square? How many sides?

2. How many right angles has the oblong? How many sides?

A figure that is bounded by four straight sides and has four right angles is a **rectangle.**

3. All squares are rectangles. What is the difference between a square and an oblong?

4. What kind of figure is the floor of your schoolroom? The ceiling?

5. What kind of figure is the blackboard?

6. Name other rectangles.

7. Draw on your paper a rectangle five inches long and one inch wide. Divide it into square inches. How many square inches are there?

8. Draw a rectangle five inches long and three inches wide.

9. Draw lines dividing it into square inches. How many square inches are there in one long row? How many rows?

10. How many square inches in all?

11. On the schoolroom floor draw a rectangle 5 ft. long and 3 ft. wide. Draw lines dividing it into square feet. How many are there?

The number of square inches, square feet, square yards, or any square unit that a rectangle contains is its **area.**

The **area** *of a rectangle is found by* **multiplying its length by its width,** *each expressed in the same unit.*

12. What is the area of a rectangle 9 in. by 7 in.?

13. What is the area of a rectangle 10 ft. long and 8 ft. wide?

14. What is the area of a lawn that is 5 rd. long and 4 rd. wide?

15. Find the area of a building lot 50 ft. wide and 120 ft. long.

16. A pane of glass is 7″ by 9″. Its area is how many square inches?

17. A floor 15′ by 12′ is covered with linoleum at $1.50 a square yard. What is the cost?

Find the areas of rectangles having the following dimensions:

1. $10' \times 6'$
2. $8'' \times 12''$
3. 5 rd. $\times$ 8 rd.
4. 20.5 ft. by 6 ft.
5. $15\frac{1}{2}$ yd. $\times$ 12 yd.
6. 1.4 rd. $\times$ 10 rd.
7. Find the area of a board 12 ft. by 9 in.
8. 65 ft. $\times$ 40 ft.
9. $18\frac{1}{2}$ mi. $\times$ 20 mi.
10. $12'' \times 18''$
11. 19 ft. $\times$ 19 ft.
12. 3 rd. $\times$ 500 rd.
13. 50 yd. $\times$ 50 yd.

These are not expressed in the same unit. The dimensions must be both in feet or both in inches. In this example it is better to reduce 9 in. to the fraction of a foot. It is $\frac{3}{4}$ of a foot. The example now reads, "Find the area of a board, 12 ft. $\times \frac{3}{4}$ ft."

14. Find the area of a rectangle 20 ft. by 5 ft. 6 in.

15. How many square yards are there in a floor 24 ft. by $15\frac{3}{4}$ ft.?

16. A field is 80 rd. by 60 rd. How many acres does it contain?

17. Using dimensions of different surfaces in and about your school, compute the areas.

18. A rectangle whose area is 40 sq. rd. is 4 rd. wide. How long is it?

19. Find the length of a 10 A. field whose width is 20 rd.

20. A rug covering 108 sq. ft. of floor is 3 yd. wide. How long is it?

Liquid Measure

4 gills (gi.)	= 1 pint (pt.)
2 pints	= 1 quart (qt.)
4 quarts	= 1 gallon (gal.)

Change to pints:

1. 19 gal.
2. 16 qt.
3. 64 gi.
4. 2 gal. 3 qt.
5. 6 gal. 2 qt.
6. 9 gal. 1 qt.
7. 40 gal.
8. 63 gal.
9. 96 gi.
10. 50 gal.
11. $31\frac{1}{2}$ gal.
12. 4 gal. 2 qt.
13. 3 gal. 1 pt.
14. 8 gal. 1 pt.
15. 7 gal. 2 qt.

Reduce to the next higher unit:

16. 284 gi.
17. 694 pt.
18. 322 pt.
19. 64 qt.
20. 96 qt.
21. 860 qt.
22. 9000 qt.
23. 8456 qt.
24. 675 gi.
25. 863 gi.
26. 297 pt.
27. 973 pt.
28. 1923 qt.
29. 2375 qt.
30. 3521 qt.
31. 2335 qt.
32. At 4¢ a pint, what will 6 qt. of milk cost?
33. 4 gal. 2 qt. equal how many quarts?
34. 63 qt. are how many gallons?
35. $6\frac{1}{2}$ gal. is how many pints?
36. How many gallons are there in 60 qt.?

Reduce to the lowest unit given:

37. 8 gal. 3 qt.
38. 9 gal. 2 qt.
39. 7 gal. 1 pt.
40. 8 gal. 2 qt.

Problems

1. A can of milk holds 10 gallons. The milk which it contains is worth how much at 14¢ a quart?

2. How many half-pint bottles can be filled from a 5-gallon storage flask of grape juice?

3. How many pints are there in $\frac{3}{4}$ of a gallon?

4. At our entertainment we sold ice cream at 10 cents a portion. A gallon made 32 portions. It cost us $1.35 a gallon. We sold 115 gallons. What was our profit?

5. What part of a gallon is 5 pints?

6. Every morning the milkman leaves 3 pints of milk at my house. What is my milk bill for the month of March, if I pay 13¢ a quart?

7. How many pints of molasses are there in a cask holding 84 gallons?

8. Find the cost of 10 gallons of milk at 9¢ a quart.

9. How many quarts are there in $42\frac{1}{2}$ gallons?

10. What decimal of a gallon is 1 qt. 2 gi.?

11. How many quarts are there in 198 gal.?

12. The yearly cost of milk for a family at 9¢ a quart is $65.70. How many gallons of milk did they use?

13. A United States transport carried 2000 men to France at one trip. How many gallons of drinking water were required to allow 3 qt. a day, per man, for 15 days?

14. 16 quarts = how many gallons?

Dry Measure

2 pints (pt.)	= 1 quart (qt.)
8 quarts	= 1 peck (pk.)
4 pecks	= 1 bushel (bu.)

Many commodities which were formerly bought and sold "in bulk" and measured by the quart, peck, or bushel, are now bought and sold by the box, case, crate, or package, these receptacles being of uniform or standard dimensions.

1. How many quarts are there in a bushel?
2. How many pints are there in a peck?
3. How many quarts are there in 3 pk.?
4. How many pecks are there in 5 bu.?

Change to the next lower denomination:

5. 14 bu.	9. 22 pk.	13. 29 pk.
6. 16 pk.	10. 80 qt.	14. 75 pk.
7. 26 bu.	11. 44 bu.	15. 4 bu.
8. 14 qt.	12. 62 qt.	16. 20 qt.

Reduce to the next higher denomination:

17. 80 pt.	20. 60 pt.	23. 128 pt.
18. 96 qt.	21. 88 qt.	24. 176 qt.
19. 72 pk.	22. 12 pk.	25. 100 pk.

Reduce to the lowest denomination given:

26. 8 bu. 3 pk.	29. 1 bu. 3 qt.	32. 3 bu. 2 pk.
27. 22 bu. 2 pk.	30. 4 bu. 2 qt.	33. 3 pk. 6 qt.
28. 3 pk. 7 qt.	31. 2 bu. 5 qt.	34. 4 bu. 5 qt.

35. How many bushels of apples at 25¢ a peck can be bought for $2?

Problems

1. This threshing-machine threshed 40 sacks of wheat in one hour. Twenty of them were weighed and found to contain 25 bushels of wheat. What was the average number of bushels in a sack?

2. A bushel of wheat weighs 60 lb. What do 25 bushels weigh?

3. If 20 sacks together contain 25 bushels of 60 lb. each, what does the wheat in one sack weigh?

4. Mr. Simons bought potatoes at 90¢ a bushel and retailed them at 30¢ a peck. What was his profit on 10 bushels?

5. A bushel of potatoes weighs 60 lb. What is the weight of a peck of potatoes?

6. A horse is fed 6 quarts of oats twice daily. How many days can he be fed from 30 bushels?

7. A basket of peaches containing 12 quarts is sold for 90¢. That is at what rate per bushel?

8. If a bushel of chestnuts is bought for $4.80 and sold for 10¢ a pint, what profit is made?

Avoirdupois Weight

16 ounces (oz.)	= 1 pound (lb.)
100 pounds	= 1 hundredweight (cwt.)
2000 pounds	= 1 ton (T.)

The term *hundredweight* is used less than formerly, although its value (100 lb.) is still taken as a unit in quoting freight rates and prices of various articles, when the quantity used makes this a convenient unit of weight.

The *long ton* of 2240 lb. is used in wholesaling certain mining products.

The ton of 2000 lb. is sometimes called a *short ton.*

1. How many ounces are there in 5 lb.?
2. 500 lb. is what part of a ton?
3. What will 500 lb. of hay cost at $18 per ton?
4. How many more pounds are there in a short ton?

Reduce to pounds:

5. $2\frac{1}{2}$ T. 6. 35 cwt. 7. 144 oz. 8. $3\frac{1}{4}$ T.

Reduce to ounces:

9. 25 lb. 10. 32 lb. 11. 8 lb. 4 oz. 12. 10 lb. 12 oz.

13. How many 4-ounce packages of candy can be made from $1\frac{1}{2}$ pounds of candy?

14. At 64¢ a pound, what will 4 oz. of tea cost?

15. At $.50 per cwt., what is the freight charge on $\frac{1}{2}$ ton of furniture?

16. How many 50-lb. sacks of salt can be filled from one ton of salt?

Problems

1. How many six-ounce packages of caramels will 72 lb. 6 oz. make?

2. How many 2-lb. packages can be made from 408 lb. of coffee?

3. At 64¢ a lb. for candy, what are 3 oz. worth?

4. Five boys share equally 1 lb. 9 oz. of candy. What is each boy's share?

5. One hundredweight is what decimal of a ton?

6. What will 8 lb. 8 oz. of sugar cost at 10¢ a pound?

7. There are 24 tons of wheat in a freight car. A truck can haul 100 bu. at a load. How many such truck loads are in the car?

8. What is the weight in tons of 3000 lb. of coal?

9. What is the cost of 2500 lb. of hay at $22 per ton?

10. If a family use 15 lb. of ice daily for 100 days, what is the cost at 40¢ per hundred?

11. A long ton is 2240 lb. Ten long tons are equal to how many common tons?

12. How many hundredweight of milk are there in a load of 22 cans at 80 lb. per can?

13. Find the cost of 4 lb. 3 oz. of meat at 20¢ a pound.

14. What must be paid for 3240 pounds of cracked corn at $30 a ton?

15. How many pounds of coal at $13.75 a ton can be bought for $2.75?

16. What must be paid for 28,400 pounds of old iron at $15 a ton?

17. Herbert's father bought 20 tons of potatoes for $600. What was the price per bushel?

Time

60 seconds (sec.)	= 1 minute (min.)
60 minutes	= 1 hour (hr.)
24 hours	= 1 day (da.)
7 days	= 1 week (wk.)
365 days	= 1 common year (yr.)
366 days	= 1 leap year

The four thirty-day months may be remembered easily by the following old rhyme:

"Thirty days hath September,
April, June, and November."

February has 28 days, with 29 in leap year. The other months have 31 days.

1. How many minutes are there in a working day of 8 hours?

2. A man who works for 30¢ an hour receives how much a minute?

3. A train that is running at the rate of 1 mile in 2 minutes goes how many miles in an hour?

4. A boy who is idle 15 minutes in every hour wastes what part of his time?

5. How many hours have we for work in a morning session of school if it begins at 9 o'clock and closes at 11.45, allowing a quarter of an hour for recess?

6. How many days are there in September, October, and November?

7. What part of a year is 4 months?

Reduce to the next lower denomination:

1. 24 weeks.	3. 30 days.	5. 15 min.	7. 36 hours.
2. 15 hours.	4. 12 weeks.	6. 40 days.	8. 90 min.

Reduce to the next higher denomination:

9. 6300 sec.	11. 553 da.	13. 360 min.	15. 894 da.
10. 900 min.	12. 840 hr.	14. 720 sec.	16. 360 hr.

Reduce :

17. 2 da. 10 hr. to minutes.

18. 3 wk. 6 da. to days.

19. 4 hr. 20 min. to seconds.

20. 3 da. 5 hr. to hours.

21. 2184 sec. to higher units.

22. 3165 min. to higher units.

23. 2000 da. to weeks and days.

24. 849 hr. to weeks and hours.

25. An alarm clock beating 4 times per second beats how many times a minute?

26. In August, September, and October there are how many days?

27. At the rate of 25 words per minute, how long will it take an operator to telegraph a thousand-word message?

28. What part of a week is 30 hours?

29. A man who has lived $7\frac{1}{2}$ decades has lived how many years?

30. If a train leaves Buffalo at 1:03 P.M. and runs to New York, arriving at 11:06 P.M., what is the time of the trip?

31. At $7.70 per week, what is the cost of board for two people for 10 days?

32. Mr. Jones arrived at his home at 5 o'clock P.M., having driven his car 2 hours and 30 minutes. At what time did he start for home?

33. The machine for making railroad spikes averages 50 spikes per minute. How many will it turn out in 8 hours at that rate?

34. Twenty-seven days and 18 hours are how many hours?

35. There are how many days in 36,000 minutes?

36. A watch which loses 30 seconds a day will be how slow in a week?

37. At $4.20 per day how much will a mechanic earn in three weeks of 6 days each?

38. How many hours must William work to earn $20 when he receives $5 for an 8-hour day?

39. Two carpenters earn together $27. If they receive $7.20 per 8-hour day, how many hours did they work for this money?

40. A wheel makes 72,000 revolutions per hour. How many revolutions does it make in 10 seconds?

41. It costs $4.20 a minute to operate a factory. Find the cost of operating this plant 8 hours a day for five and one half days.

42. A machine operating continuously from 8 o'clock Monday morning until 12 o'clock Saturday noon produced 53,760 yards of tape. How many yards did it produce per minute?

43. A carpenter was idle 73 days of the year 1925. What part of the year did he work?

44. A laborer works 8 hours a day. What fractional part of 12 hours does he work?

Addition

Optional

1. Find the sum of 5 ft. 8 in. and 6 ft. 10 in.

Ft.	In.
5	8
6	10
12	6

Say, "10 in. and 8 in. = 18 in., which is 1 ft. 6 in."
Write 6 in the column under in.
Carry 1 ft. to the next column.
Say, "7 ft. and 5 ft. = 12 ft."
Write 12 in the column under ft.

Find the sums :

2.

Ft.	In.
6	6
9	8

3.

Lb.	Oz.
8	12
4	9

4.

Gal.	Qt.
10	3
12	2

5.

Bu.	Pk.
10	3
12	3

6.

Yd.	In.
4	18
3	20

7.

£	s.
4	12
5	15

8.

Hr.	Min.
2	30
3	40
1	20

9.

Lb.	Oz.
10	12
7	14
2	10

10.

Mo.	Da.
4	3
3	20
6	15

11.

A.	Sq. Rd.
8	20
22	150
12	135

12.

Ft.	In.
16	11
15	7
19	5

13.

Gal.	Qt.
6	2
5	3
7	2

14. Find the sum of 22 ft. 8 in., 30 ft. 10 in., 22 ft. 4 in., 16 ft. 6 in., and 13 ft. 6 in.

NOTE. — Excepting in the subtraction of dates, computations with compound numbers are rarely used. Such numbers may be reduced to like denominations, and the required operations performed, as in simple numbers.

Subtraction

Optional

Find the difference between 6 ft. 4 in. and 4 ft. 8 in.

Ft.	In.
6	4
4	8
1	8

Say, "8 in. and 8 in. (writing 8) = 16 in. (1 ft. 4 in.)."
Carry 1 ft. to 4 ft. and call it 5 ft.
Say, "5 ft. and 1 ft. (writing 1) = 6 ft."

	Ft.	In.
1.	4	6
	2	4

	Bu.	Pk.
2.	6	3
	2	1

	Hr.	Min.
3.	14	40
	8	36

	Ft.	In.
4.	1	6
		8

	Gal.	Qt.
5.	1	2
		3

	Mo.	Da.
6.	1	10
		22

	Hr.	Min.
7.	1	15
		30

	Yd.	In.
8.	1	15
		30

	Sq. Ft.	Sq. In.
9.	1	85
		102

	Ft.	In.
10.	3	6
	1	8

	Gal.	Qt.
11.	4	2
	2	3

	Mo.	Da.
12.	6	10
	4	22

	Hr.	Min.
13.	6	15
	2	20

	Yd.	In.
14.	12	20
	4	30

	Mo.	Da.
15.	8	4
	2	10

	Mi.	Rd.
16.	4	150
	1	200

	Yr.	Mo.
17.	1920	4
	1916	8

	Mo.	Da.
18.	80	00
	20	12

19. From a package containing 8 lb. 12. oz. of butter 3 lb. 15 oz. are sold. Find the weight of the butter remaining in the package.

20. Subtract 140 sq. rods from 1 acre.

Subtracting Dates

Optional

1. Find the time from Mar. 4, 1916 to Jan. 10, 1918.

1918	1	10
1916	3	4
1	10	6

Use the *later* date as the *minuend.*
Use the *number* of the month in place of its name.
Consider 30 days as 1 month.

Find the time from

2. July 4, 1863 to Mar. 4, 1888.
3. Aug. 10, 1912 to Jan. 1, 1918.
4. June 7, 1914 to Feb. 10, 1917.
5. Jan. 1, 1917 to Oct. 10, 1917.
6. April 12, 1916 to Nov. 1, 1917.
7. Find the time from June 10, 1912 to Jan. 1, 1915.
8. Find the time from March 4, 1916 to Sept. 1, 1920.
9. Find your exact age, to-day, in years, months, and days.

Subtract:

	Yr.	Mo.	Da.
10.	1925	8	12
	1924	6	8
11.	1926	9	20
	1924	3	7
12.	1926	3	8
	1918	9	12
13.	1922	4	20
	1914	8	6
14.	1924	8	16
	1917	2	20
15.	1923	9	15
	1918	2	25

16. The United States Army Air Service planes in the Round the World flight left Seattle, Washington on April 6, 1924 and returned to Seattle on September 28, 1924. Determine the number of days between the departure and the return.

	Yr.	Mo.	Da.
1.	1919	9	28
	1916	3	21

	Yr.	Mo.	Da.
2.	1920	12	15
	1917	8	9

3.	1921	6	10
	1920	8	4

4.	1922	1	1
	1920	9	30

Find the time from

5. April 20, 1918 to April 20, 1920.
6. March 1, 1920 to July 21, 1922.
7. Sept. 30, 1919 to Feb. 1, 1920.
8. July 1, 1919 to August 20, 1920.
9. June 23, 1918 to Sept. 13, 1919.

Find the exact age in years, months, and days, of each of these men :

10. John Adams, born Oct. 31, 1735, died July 4, 1826.
11. Benjamin Franklin, born Jan. 17, 1706, died April 17, 1790.
12. Thomas Jefferson, born April 2, 1743, died July 4, 1826.
13. John Hancock, born Jan. 12, 1737, died Oct. 8, 1793.
14. Washington, born Feb. 22, 1732, died Dec. 14, 1799.
15. Lincoln, born Feb. 12, 1809, died April 15, 1865.
16. Cleveland, born Mar. 18, 1837, died June 24, 1908.
17. William Henry Harrison, born Feb. 9, 1773, died April 4, 1841.
18. Benjamin Harrison, born Aug. 20, 1833, died Mar. 13, 1901.

Optional **Multiplication**

1. Multiply 8 ft. 6 in. by 5.

Ft.	In.	
8	6	The product of 5 and 6 is 30.
	5	30 in. = 2 ft. 6 in. Write **6** under **in.**
42	6	The product of 5 and 8 is 40.
		40 ft. and 2 ft. = 42 ft. Write **42** under **ft.**

The result is 42 ft. 6 in.

Multiply :

2. 4 ft. 4 in. by 4.
3. 8 bu. 2 pk. by 8.
4. 4 wk. 4 da. by 7.
5. 2 hr. 4 min. by 20.
6. 7 lb. 12 oz. by 9.
7. 3 yd. 2 ft. 6 in. by 5.
8. 5 A. 80 sq. rd. by 12.
9. 2 cwt. 72 lb. by 6.

Division

10. Divide 11 ft. 4 in. by 8.

$$8\overline{)11 \text{ ft. } 4 \text{ in.}}$$

8 in 11 once with a remainder of 3. Write **1** above 11 ft.
3 ft. = 36 in. 36 in. and 4 in. = 40 in.
8 in 40 5 times Write **5** above 4 in.
The quotient is 1 ft. 5 in.

Divide :

11. 30 ft. 4 in. by 7.
12. 22 lb. 8 oz. by 9.
13. 162° 48′ by 12.
14. 52 hr. 4 min. by 22.
15. 16 bu. 3 pk. 6 qt. by 10.
16. 53 gal. 2 qt. 6 pt. by 14.
17. 10 hr. 12 min. 24 sec. by 18.
18. 15 yd. 2 ft. 3 in. by 7.

Mental Test

1. $15 - \frac{3}{4} = ?$
2. $9 + 2\frac{5}{8} = ?$
3. What is the cost of $\frac{3}{4}$ lb. of cinnamon at 32¢ a pound ?
4. One bushel = how many quarts?
5. In a gallon, there are how many quarts?

Problems

1. What will it cost to paint a ceiling 24 ft. long and $16\frac{1}{2}$ ft. wide, at 25 cents a square yard?

2. What is the length of one side of a square garden whose perimeter is 632 feet?

3. What will it cost at 65 cents a square yard to cover with matting a floor 21 ft. long and 15 ft. wide?

4. There are 5280 ft. in a mile. If steel rails are 30 ft. long, how many are needed for 8 miles of railroad track?

5. At the rate of 660 feet a minute, how many miles will a street car run in two hours?

6. What is the cost, at \$1.80 per rod, of a fence inclosing a rectangular field 50 rd. by 34 rd.?

7. Find the cost at $\frac{1}{2}¢$ per foot of five miles of telephone wire.

8. At 40¢ per square yard, what will it cost to build a walk 6 ft. wide and 60 feet long?

9. Three barrels of witch hazel are put up in pint bottles and sold for 20¢ a bottle. How much is received for it?

10. A grocer bought 40 bbl. of cider at \$3.50 a barrel, made it into vinegar, and sold it at 8¢ a quart. How much did he gain?

11. Divide, in the shortest way, the product of 36, 40, 144, 8, and 160 by the product of 18, 272, and 6.

12. Mr. C. J. Hogan has laid for Mr. Henry Sumner a piece of Portland cement walk 50 ft. long and 5 ft. wide at $12\frac{1}{2}¢$ a square foot. Make out the bill and receipt it.

13. Mr. Burke has a lot which is 16 rd. wide. He wishes to divide it into 3 building lots of equal width. How wide will each lot be?

14. Mr. Porter bought a piece of land having frontage of 15 rods. He sold two building lots each 50 ft. wide and two others each 44 ft. wide. How wide was the remaining lot?

15. From a board 12 ft. long Mr. Pierce cut a piece 18 in. long. How long was the part remaining?

16. Allowing 15 sq. ft. of floor space for each pupil, how many pupils could be seated in a room 30 ft. square?

17. A large school used 3 tons of pea coal a day during December and January. How many tons were used during those two months?

18. How many more hours are there in May than in June?

19. At $4 a day how much can a man earn in 3 weeks if he does not work Saturday afternoons or Sundays?

20. Mr. Bunker put 5 gallons of glycerine into $\frac{1}{2}$ pt. bottles. How many bottles did he need?

21. A watch ticks 5 times every second. How many times does it tick in an hour?

22. How many days is it from Memorial Day to the Fourth of July?

23. What part of 52 weeks is left for vacation when there are 40 weeks of school in that time?

24. A boy spends 6 hours in study. What part of the day does he spend otherwise?

25. Mr. Brown worked 20 days in the month of September. What part of the month was he without employment?

Averages

1. Jacob weighed six of his chickens and found their weights to be 68 oz., 40 oz., 63 oz., 47 oz., 55 oz., and 70 oz. What was the average weight of the chickens?

68
40
63
47
55
70
6)343 oz. *Total*
$57\frac{1}{6}$ oz. *Average.*

2. Harry's marks in spelling for a month were as follows:

	1st Week	2d Week	3d Week	4th Week
Monday	80	75	78	80
Tuesday	86	90	84	88
Wednesday	83	82	90	92
Thursday	88	80	86	96
Friday	92	76	90	100

3–6. Find Harry's average for each week.

7. What was Harry's general average for the month?

8. Our outdoor thermometer indicated the following temperatures for the mornings of last week: 76°, 82°, 80°, 67°, 60°, 70°, 81°. The week before the record was 60°, 63°, 58°, 57°, 70°, 68°, 72°. For which week was the average temperature higher, and how much higher was it?

9. The Lincoln High School football team played six games, making the following scores: 19, 7, 0, 6, 25, 19. What was the average score?

10. What is the average weight of 4 men weighing 148 lb., 189 lb., 210 lb., and 196 lb.?

11. James Smith found the following marks on his report card: Arithmetic 84, English 81, Geography 92, Spelling 95, Reading 87, and Writing 88. What is his average?

Articles Sold by the Thousand, Hundred, or Hundredweight

1. What is the cost of 8975 bricks at \$7 per M? (M stands for 1000.)

8975 = 8.975 M. $8.975 \times 7 = ?$

The *number* of dollars is the product of 8.975 and 7.

2. What must be paid for 980 pencils at \$2.30 per C? (C stands for 100.)

980 = 9.80 C. $9.80 \times 2.30 = ?$

3. Find the cost of 1550 lb. of new buckwheat flour at \$3.50 per cwt.

1550 lb. = 15.50 cwt. 15.50×3.50.

In final results, a fraction of a cent, equal to or greater than $\frac{1}{2}$ cent, is counted a whole cent. A fraction which is less than $\frac{1}{2}$ cent is dropped.

Find the cost of each of the following items and the total cost of all of them :

4. 27,325 bricks at \$8.15 per M.

5. 4900 cu. ft. of gas at \$1.20 per M.

6. 583 lb. sugar at \$6.75 per C.

7. 4900 tomato plants at \$4.50 per M.

8. 1000 laths at 40¢ per C.

9. 3125 cu. ft. of city water at \$.14 per C.

10. $\frac{1}{2}$ T. fiber paper at \$4.50 per cwt.

11. 5600 paper bags at \$4.90 per M.

12. 16 boxes of envelopes, 250 in a box, at \$1.50 per M.

13. 850 Japanese napkins at \$.28 per C.

Problems

1. What is $\frac{1}{2}$ of 12?

STATEMENT: $\frac{1}{2}$ of 12 = ?
SOLUTION: $\frac{1}{2} \times 12 = 6$.

2. A basketball team scored 45 points and the right forward scored $\frac{1}{3}$ of them. How many points did he score?

3. Frank had \$12 and spent $\frac{1}{2}$ of it for skates. How much did his skates cost?

4. Find $\frac{1}{3}$ of 18 apples.

STATEMENT: $\frac{1}{3}$ of 18 apples = ?
SOLUTION: $\frac{1}{3} \times 18$ apples = 6 apples.

5. Find the number of pecks in $\frac{1}{2}$ bushel of potatoes.

6. Find $\frac{2}{3}$ of 60 acres.

7. Find $\frac{1}{5}$ of \$60.

8. Find $\frac{3}{4}$ of 84 gallons.

9. What part of a dozen is 6?

One dozen = 12.
STATEMENT: $? \times 12 = 6$
SOLUTION: $6 \div 12 = \frac{1}{2}$.

or

One dozen = 12
$6 = \frac{6}{12}$ of 12
$\frac{6}{12} = \frac{1}{2}$

10. In an orchard of 160 trees, 40 were pear trees. What part of the orchard was pear trees?

11. Out of a flock of 36 ducks, 12 were killed by a fox. The number killed were what part of the flock?

12. A basketball team scored 45 points and the right forward scored 15 points. What part did he score?

13. A team won 20 games. This is $\frac{1}{3}$ of the games played during the season. How many games were played?

STATEMENT: $\frac{1}{3} \times ? = 20$
SOLUTION: $20 \div \frac{1}{3} = 60$
$\therefore$ 60 games.

or

$\frac{1}{3}$ of games played = 20
$\frac{3}{3}$ of games played = 3×20
or 60 games.

What is :

1. $\frac{1}{2}$ of 8?
2. $\frac{1}{3}$ of 12?
3. $\frac{1}{8}$ of 24?
4. $\frac{1}{6}$ of 12?
5. $\frac{2}{3}$ of 12?
6. $\frac{3}{4}$ of 12?
7. $\frac{2}{5}$ of 15?
8. $\frac{3}{8}$ of 16?
9. $\frac{1}{5}$ of 70?
10. $\frac{1}{4}$ of 84?
11. $\frac{1}{2}$ of 68?
12. $\frac{1}{3}$ of 36?
13. $\frac{5}{8}$ of 48?
14. $\frac{2}{3}$ of 66?
15. $\frac{1}{6}$ of 72?
16. $\frac{7}{8}$ of 96?

Find:

17. $\frac{1}{5}$ of 20
18. $\frac{1}{4}$ of 32
19. $\frac{1}{2}$ of 26
20. $\frac{1}{3}$ of 15
21. $\frac{2}{3}$ of 15
22. $\frac{5}{8}$ of 24
23. $\frac{6}{7}$ of 42
24. $\frac{7}{8}$ of 40
25. $\frac{3}{4}$ of 72
26. $\frac{2}{5}$ of 20
27. $\frac{1}{8}$ of 48
28. $\frac{3}{8}$ of 56
29. $\frac{5}{6}$ of 36
30. $\frac{3}{5}$ of 40
31. $\frac{3}{10}$ of 70
32. $\frac{4}{5}$ of 80

What part of

33. 12 is 6?
34. 18 is 3?
35. 15 is 5?
36. 20 is 12?
37. 24 is 16?
38. 32 is 8?
39. 36 is 12?
40. 40 is 16?
41. 32 is 10?
42. 50 is 40?
43. 20 is 4?
44. 16 is 12?
45. 15 is 5?
46. 18 is 3?
47. 75 is 30?
48. 27 is 9?

49. 8 is what part of 32?
50. 3 is what part of 27?
51. 5 is what part of 40?
52. 8 is what part of 24?
53. 6 is what part of 14?
54. 14 is what part of 21?
55. 12 is what part of 27?
56. 20 is what part of 24?
57. 12 is $\frac{1}{2}$ of what number?
58. 16 is $\frac{1}{3}$ of what number?
59. 5 is $\frac{1}{4}$ of what number?
60. 18 is $\frac{1}{3}$ of what number?
61. 15 is $\frac{1}{2}$ of what number?
62. 6 is $\frac{1}{7}$ of what number?
63. 11 is $\frac{1}{5}$ of what number?
64. 23 is $\frac{1}{2}$ of what number?
65. 10 is $\frac{2}{5}$ of what number?
66. 12 is $\frac{3}{4}$ of what number?
67. 20 is $\frac{4}{5}$ of what number?
68. 21 is $\frac{3}{7}$ of what number?
69. 24 is $\frac{2}{3}$ of what number?
70. 35 is $\frac{5}{8}$ of what number?
71. 42 is $\frac{3}{7}$ of what number?
72. 30 is $\frac{5}{6}$ of what number?

Review

1. What is $\frac{2}{3}$ of 24?
2. Find $\frac{1}{2}$ of 60.
3. 8 is what part of 48?
4. Find $\frac{1}{6}$ of 3 dozen apples.
5. Find $\frac{2}{5}$ of 5 dollars.
6. What is $\frac{3}{25}$ of 75?
7. 16 is $\frac{2}{3}$ of what number?
8. What is $\frac{7}{10}$ of 160?
9. Find $\frac{1}{2}$ of 68.
10. What part of 120 is 40?
11. 9 is $\frac{3}{5}$ of what number?
12. Find $\frac{1}{4}$ of 72.
13. Find $\frac{3}{5}$ of 65.
14. What is $\frac{3}{4}$ of one dollar?
15. 10 is what part of 60?
16. 10 is $\frac{5}{12}$ of what number?
17. Find $\frac{7}{20}$ of 140.
18. What is $\frac{1}{3}$ of 60?
19. What is $\frac{3}{4}$ of 2 dozen pencils?
20. Find $\frac{1}{5}$ of 65.
21. What is $\frac{3}{4}$ of a yard?
22. Ten dollars is what part of forty dollars?
23. Find $\frac{3}{5}$ of 25.
24. What is $\frac{1}{12}$ of 72?
25. 26 is $\frac{2}{5}$ of what number?
26. What part of a dozen is 4?
27. What is $\frac{5}{6}$ of 42?
28. 12 is $\frac{3}{4}$ of what number?

Problems

1. Mr. Brown received \$180 a month and paid \$45 a month for rent. What part of each month's salary did he pay for rent?

2. John received \$5.40 for peddling papers and spent $\frac{1}{3}$ of it for school supplies. How much did his school supplies cost him?

3. Miss Dunn took an automobile trip that cost her \$37.60. She found that her gasoline and oil amounted to one half of her expense. How much did the gasoline and oil cost?

4. A milkman buys 108 quarts of milk and sells $\frac{3}{4}$ of it. How many quarts does he sell?

5. A football team played 10 games and won $\frac{4}{5}$ of them. How many did it win?

6. A track team scored 45 points in a track meet and the captain scored 9. What part of the total score did the captain make?

7. Find $\frac{3}{5}$ of ten dozen.

8. In a load of peaches containing 60 baskets there were 6 baskets which were spoiled. What part of the load was spoiled?

9. The cost of running a school is \$72 per pupil. The teachers' salaries are $\frac{2}{3}$ of this cost. How much of the \$72 goes for teachers' salaries?

10. A farmer has an income of \$2500 from his farm. From his dairy he receives $\frac{4}{5}$ of this amount. How much money does he receive from his dairy?

11. An orchard contains 150 trees, $\frac{2}{3}$ of which are apple trees. How many apple trees are there in the orchard?

12. James worked 8 problems and had 4 yet to do. What part of the total lesson did he have done?

13. A boy earned \$4.50 cleaning walks and \$2.60 carrying out ashes. He spent $\frac{1}{2}$ of all his money for a book. How much did his book cost?

14. A baseball team won 20 games and lost 8. What part of the games played did the team win?

15. Mrs. Rice spent \$.50 for a pound of coffee, \$.60 for a pound of tea, and \$1.40 for a sack of flour. What part of the whole did she spend for coffee?

16. Mrs. Brown's weekly income was \$24. She spent \$18 for running expenses. What fractional part of her money was left?

17. Dr. Persons had a plot of land which he planted as follows: 4 acres to potatoes, 6 acres to corn, and 2 acres to cabbage. What part of the land did he plant to potatoes?

18. Mr. Borden bought 8 tons of stove coal and 2 tons of chestnut coal. What part of the coal bought was stove coal?

19. In a schoolroom there were 20 boys and 28 girls. What part of the pupils were boys?

20. In a flock of hens there were 150 White Leghorns and 100 Rhode Island Reds. What part of the flock were White Leghorns?

21. A trolley company had 50 miles of track inside the city and 30 miles outside. What part of the track was outside the city?

22. Mr. Wolf's store sold \$150 worth of goods for cash and \$300 on credit. What part of the sales was sold on credit?

PERCENTAGE

Per cent is another name for *hundredths.*

Six *per cent* means six *hundredths.*

The **sign of percentage** is % and is read *per cent* or *hundredths.*

5% = 5 hundredths or .05 or $\frac{5}{100}$ or 5 per cent.

The *number of hundredths* is the **rate** or **rate per cent.**

100% or $\frac{100}{100}$ = 1.00 or 1. 150% or $\frac{150}{100}$ = 1.50 or $1\frac{1}{2}$.

Read as hundredths :

1.	4%	**6.**	24%	**11.**	14%	**16.**	11%	**21.**	9%
2.	2%	**7.**	17%	**12.**	21%	**17.**	31%	**22.**	48%
3.	3%	**8.**	13%	**13.**	51%	**18.**	73%	**23.**	56%
4.	6%	**9.**	53%	**14.**	33%	**19.**	100%	**24.**	91%
5.	9%	**10.**	19%	**15.**	53%	**20.**	26%	**25.**	86%

Write as decimals :

26.	1%	**31.**	18%	**36.**	37%	**41.**	46%	**46.**	61%
27.	7%	**32.**	26%	**37.**	39%	**42.**	52%	**47.**	62%
28.	5%	**33.**	29%	**38.**	44%	**43.**	59%	**48.**	46%
29.	8%	**34.**	38%	**39.**	49%	**44.**	64%	**49.**	77%
30.	10%	**35.**	34%	**40.**	36%	**45.**	66%	**50.**	96%

Write as decimals ; then reduce to common fractions in simplest form :

51.	5%	**56.**	20%	**61.**	40%	**66.**	54%	**71.**	68%
52.	8%	**57.**	22%	**62.**	42%	**67.**	55%	**72.**	70%
53.	10%	**58.**	25%	**63.**	45%	**68.**	58%	**73.**	75%
54.	12%	**59.**	28%	**64.**	48%	**69.**	60%	**74.**	80%
55.	15%	**60.**	35%	**65.**	50%	**70.**	65%	**75.**	85%

1% = .01	$12\frac{1}{2}\%$ = .12½ or .125
10% = .10	$33\frac{1}{3}\%$ = .33⅓
90% = .90	$8\frac{1}{4}\%$ = .08¼ or .0825
100% = 1.00	$\frac{1}{2}\%$ = .00½ or .005
125% = 1.25	$\frac{1}{4}\%$ = .00¼ or .0025

Care must be taken that every fractional part of 1% be written at the right of the hundredths' place.

Express decimally :

1. 2%	**6.** $12\frac{1}{2}\%$	**11.** 120%	**16.** $\frac{1}{2}\%$
2. 5%	**7.** $18\frac{1}{4}\%$	**12.** 105%	**17.** $\frac{1}{4}\%$
3. 7%	**8.** $25\frac{3}{4}\%$	**13.** 150%	**18.** $\frac{3}{5}\%$
4. 12%	**9.** $37\frac{1}{2}\%$	**14.** 200%	**19.** $\frac{3}{4}\%$
5. 27%	**10.** $66\frac{7}{8}\%$	**15.** $127\frac{1}{2}\%$	**20.** $\frac{9}{10}\%$

Express with the sign % :

21. .10	**24.** .166	**27.** 2.	**30.** .8
22. .12	**25.** .215	**28.** 4.	**31.** 1.15
23. $.12\frac{1}{2}$	**26.** .267	**29.** $.37\frac{1}{2}$	**32.** 2.10

33. Express $\frac{3}{4}$ as hundredths with the sign %.

SOLUTION: $\frac{3}{4} = 3 \div 4 = .75 = 75\%$. $\frac{7}{8} = 7 \div 8 = .875 = 87\frac{1}{2}\%$.

Express as hundredths with the sign % :

34. $\frac{1}{2}$	**40.** $\frac{4}{5}$	**46.** $\frac{3}{10}$	**52.** $\frac{5}{4}$
35. $\frac{1}{4}$	**41.** $\frac{1}{8}$	**47.** $\frac{1}{6}$	**53.** $\frac{1}{25}$
36. $\frac{1}{3}$	**42.** $\frac{2}{3}$	**48.** $\frac{3}{5}$	**54.** $\frac{7}{8}$
37. $\frac{1}{5}$	**43.** $\frac{2}{5}$	**49.** $\frac{5}{6}$	**55.** $\frac{1}{50}$
38. $\frac{3}{8}$	**44.** $\frac{3}{7}$	**50.** $\frac{5}{8}$	**56.** $\frac{9}{10}$
39. $\frac{3}{3}$	**45.** $\frac{1}{9}$	**51.** $\frac{4}{4}$	**57.** $\frac{3}{2}$

1. The whole of anything is what per cent of it?

2. 1 equals how many hundredths?

3. 5 equals how many hundredths?

4. $1\frac{1}{2}$ equals how many hundredths?

5. 1.40 equals how many %?

6. $\frac{1}{2}$ = how many hundredths? What per cent?

7. How many hundredths are equal to $\frac{1}{3}$? $\frac{1}{4}$? $\frac{1}{5}$? $\frac{1}{8}$? $\frac{1}{10}$? $\frac{1}{16}$? $\frac{1}{12}$? $\frac{2}{3}$?

8. What per cent is the same as $\frac{1}{10}$? $\frac{1}{8}$? $\frac{1}{3}$? $\frac{7}{8}$? $\frac{2}{5}$? $\frac{3}{4}$? $\frac{3}{8}$?

9. What per cent of anything is left after 50% of it has been taken away? After 75% of it has been taken away? 30%? 40%? 35%? $33\frac{1}{3}\%$? $62\frac{1}{2}\%$? $37\frac{1}{2}\%$? $83\frac{1}{3}\%$? $16\frac{2}{3}\%$? 49%? 1%? $2\frac{1}{2}\%$? $98\frac{1}{2}\%$?

10. A baseball team won $67\frac{1}{2}\%$ of its games. What per cent did it lose?

11. 35% of the city tax budget is used for school purposes. What per cent is used for other purposes?

12. 97 per cent of the pupils belonging to Bryant school were present. What per cent of the pupils were absent?

13. $2\frac{1}{2}\%$ of the pupils in a school were absent. What per cent of the pupils were present?

14. Henry gives 50% of his wages to his mother, puts 25% in the savings bank, and keeps the rest to spend. What per cent does he spend?

15. 45% of the depositors in Mr. Bixby's bank are members of the Christmas Club. If there are 1600 depositors, how many members are there in the club?

Some *per cents* are equal to common fractions which are more convenient to use in computation than the decimal forms.

Memorize the following:

$5\% = \frac{1}{20}$	$25\% = \frac{1}{4}$	$62\frac{1}{2}\% = \frac{5}{8}$
$6\frac{1}{4}\% = \frac{1}{16}$	$30\% = \frac{3}{10}$	$66\frac{2}{3}\% = \frac{2}{3}$
$8\frac{1}{3}\% = \frac{1}{12}$	$33\frac{1}{3}\% = \frac{1}{3}$	$70\% = \frac{7}{10}$
$10\% = \frac{1}{10}$	$37\frac{1}{2}\% = \frac{3}{8}$	$75\% = \frac{3}{4}$
$12\frac{1}{2}\% = \frac{1}{8}$	$40\% = \frac{2}{5}$	$80\% = \frac{4}{5}$
$16\frac{2}{3}\% = \frac{1}{6}$	$50\% = \frac{1}{2}$	$87\frac{1}{2}\% = \frac{7}{8}$
$20\% = \frac{1}{5}$	$60\% = \frac{3}{5}$	$90\% = \frac{9}{10}$

Cover the above table and see how quickly you can give the fractions equal to :

1. 50%
2. 25%
3. $12\frac{1}{2}\%$
4. $6\frac{1}{4}\%$
5. $37\frac{1}{2}\%$
6. $62\frac{1}{2}\%$
7. $87\frac{1}{2}\%$
8. $66\frac{2}{3}\%$
9. $33\frac{1}{3}\%$
10. $16\frac{2}{3}\%$
11. $8\frac{1}{3}\%$
12. 10%
13. 20%
14. 30%
15. 40%
16. 60%
17. 70%
18. 80%
19. 90%
20. 75%

Using common fractions instead of decimals, find :

21. 50% of \$124
22. 25% of 36
23. 75% of 24
24. $33\frac{1}{3}\%$ of 999
25. $66\frac{2}{3}\%$ of 42
26. $83\frac{1}{3}\%$ of 30
27. $16\frac{2}{3}\%$ of 48 bushels
28. $14\frac{2}{7}\%$ of 49 feet
29. $12\frac{1}{2}\%$ of 30 inches
30. $37\frac{1}{2}\%$ of 64 days
31. $87\frac{1}{2}\%$ of 72 pounds
32. $8\frac{1}{3}\%$ of 132 square miles
33. 5% of \$200
34. $6\frac{1}{4}\%$ of 32 quarts

Problems

Find :

1. $12\frac{1}{2}\%$ of 896 bu.
2. $66\frac{2}{3}\%$ of 927 T.
3. $87\frac{1}{2}\%$ of 240 gal.
4. $16\frac{2}{3}\%$ of 636 qt.
5. 40% of 120
6. $12\frac{1}{2}\%$ of 160 lb.
7. $16\frac{2}{3}\%$ of 360
8. 20% of 250 yd.
9. 30% of 700 pupils
10. 5% of \$90
11. $66\frac{2}{3}\%$ of 66 miles
12. 50% of \$8.50
13. $12\frac{1}{2}\%$ of \$15,000.
14. 5% of 15,000.
15. 50% of 200 tickets.
16. 30% of 480.
17. $37\frac{1}{2}\%$ of \$720.
18. $62\frac{1}{2}\%$ of 640 books.
19. $33\frac{1}{3}\%$ of \$963.
20. 25% of \$16.84.
21. $8\frac{1}{3}\%$ of \$288.
22. 75% of \$960.
23. $87\frac{1}{2}\%$ of \$128.
24. 90% of 810 men.

25. Arthur earned \$1.60 and paid 75% of it for a baseball. How much did he pay? How much had he left?

26. Mr. Arnold raised 240 bushels of potatoes and saved $12\frac{1}{2}\%$ of them for seed. How many bushels did he save for seed?

27. In an orchard of 3600 trees, 25% were pear trees, 15% peach trees, 10% plum trees, and the rest apple trees. How many apple trees were there?

28. A farmer raised 360 bushels of potatoes and sold $33\frac{1}{3}\%$ of them. How many bushels did he sell?

29. A milliner deducted $16\frac{2}{3}\%$ from the price of a hat which was marked \$9. How much was deducted and for how much was it to be sold?

30. A cubic foot of ice weighs $62\frac{1}{2}$ lb. If 10% of it melts away, how many pounds will be lost?

31. Roger earned \$80, and put $87\frac{1}{2}\%$ of it in the bank. How much money did he put in the bank?

Percentage is *computing in hundredths.*

Problems involving computing in hundredths usually present one of the two questions of relation between product and factors; namely,

a. Two factors given to find the product.

b. The product and one factor given to find the other factor.

1. 17% of $30 is how much money?

17% = .17
STATEMENT: .17 × $30 = ?
SOLUTION: .17 × $30 = $5.10. *Ans.*
In this case two factors are given to find the product.

2. Mr. Henderson sold his house for $5000 and invested 37% of the money in railroad stock. How much did he invest?

3. A house worth $8500 rents for 12% of its value. What is the amount of the rent?

4. Henry bought a bicycle for $42 and sold it for 85% of its cost. What did he get for it?

5. How many feet are there in 15% of a mile?

6. In a school of 175 pupils 44% are boys. How many boys are there in the school?

7. How many people must move into a village of 350 people to increase its population 40%?

8. One day's business in a store amounted to $1284, of which only 35% was cash. What was the cash business of that day?

9. Pure gold is estimated to be 24 karats fine. How many karats fine is a ring which is 75% gold?

10. What is 38% of 640 miles?

11. Mr. Coy drove his automobile 8450 miles one summer at a cost of 8 cents a mile. His gasoline bill was 32% of the entire operating expense. What did his gasoline cost?

12. Mr. Coy's car cost $1385. At the end of the year he estimated it had depreciated 35% in value. How many dollars did he think it had depreciated?

13. A restaurant keeper found that his profit on meals was 14%. What was his profit on a meal for which he received $2.25?

14. What is 172% of $3846?

15. The cost of a city's schools for one year is $1,895,464. 68% of this is spent for teachers' wages. What is the amount of teachers' wages?

16. A street car line has 68 miles of track, 16% of which is placed beyond the city limits. How many miles are placed beyond the city limits?

17. Find 86% of 320.

18. Leona had $1.80 and spent $.36 for a box of writing paper. What per cent of her money did she spend?

STATEMENT: ?% × $1.80 = $.36.
SOLUTION: .36 ÷ 1.80 = .20 = 20%.
In this case we have given a product and one of its factors to find the other factor.

19. Eight quarts is what per cent of 32 qt.?

20. Three pints is what per cent of a gallon?

21. $20 is what per cent of $25?

22. $25 is what per cent of $20?

23. 300 lb. is what per cent of a ton?

24. Mr. Arnold earns $1600 a year, of which he saves $240. What per cent of his earnings does he save?

25. Mr. Jones rents his house worth $9000 for $810 a year. The rent is what per cent of the value of the house?

26. What per cent of 120 is 6?

27. What per cent of \$125 is \$6.25?

28. What per cent of 56 bu. is 70 bu.?

29. What per cent of 16 mi. is 6 mi.?

30. What per cent of 24 hr. is 2 hr.?

31. \$48 is what % of \$320?

32. \$12 is what % of \$200?

33. \$7.20 is what % of \$180?

34. 18 yr. is what % of 50 yr.?

35. 65 lb. is what % of 195 lb.?

36. In a school of 800 pupils there were 44 failures. What was the percentage of failure?

37. On a book which retails for \$1.20 the author receives a royalty of 6 cents. What per cent of the selling price is his royalty?

38. A judge collected fines of \$1320 in one week; \$400 was for violations of the speed ordinances. This was what per cent of the whole?

39. The Library Club increased its membership from 420 to 600. The increase was what per cent of its original membership?

40. Mr. Humbert bought a motor boat for \$320 and sold it for \$400. The selling price was what per cent of the purchase price?

41. A garment marked \$400 was sold for \$320. The sale price was what per cent of the marked price?

42. Henry had 24 papers to sell. He sold 16. What per cent remained unsold?

43. Jack is in school 32 hours a week. What per cent of the seven days is Jack's schooltime?

44. 35% of Frank's money is \$7. How much money has he?

STATEMENT: $35\% \times ? = \$7.$
SOLUTION: $7 \div .35 = 20.$ \$20. *Ans.*

In this case the product and one of the factors are given to find the other factor.

45. When 60% of Paul's earnings is \$1.50, how much does he earn?

46. Mr. Dunbury borrowed \$3600 to use in building his house. The loan was 40% of the value of the house. What was the house worth?

47. Of Mr. Gilbert's apple crop only 864 bushels, or 90% of his crop, was fit for market. What was his entire crop?

48. The labor on a branch sewer cost \$1440. This was 18% of the whole cost. What was the entire cost?

49. A school of 252 pupils is 21% of the population of the district. What is the population of the district?

50. \$840 is 42% of how much money?

51. A mile is 150% of how many feet?

52. Twenty oranges, 16% of a crate, were spoiled in shipment. How many oranges were there in the crate?

53. The Hamilton School baseball team won 18 games out of 24 played. What per cent of the games played did they win?

54. Mr. Bowman sold a house which cost him \$3400 at a gain of \$510. What per cent of the cost did he gain?

55. Out of 65 times at bat Paul hit safely 15 times. What is his batting per cent?

56. Of a college class of 660 students only 412 graduated. What per cent failed to graduate?

The following principles have special application in percentage. Their use will help you to check your work.

I. *When the divisor is less than* 1, *the quotient is greater than the dividend.*

1. $3 \div \frac{1}{2} = ?$
2. $6 \div \frac{1}{3} = ?$
3. $4 \div \frac{1}{4} = ?$
4. $20 \div .05 = ?$
5. $16 \div .25 = ?$
6. $\$60 \div .06 = ?$
7. $12 \div 4\% = ?$
8. $\$7 \div 8\% = ?$
9. $\$15 \div 5\% = ?$

10. During a year the Smith Hardware Co. made a profit of $18,000, which was 15% of its sales. What was the amount of its sales?

II. *When the divisor is greater than the dividend the quotient is less than* 1.

11. $80 \div 320 = ?$
12. $15 \div 24 = ?$
13. $\$6 \div \$50 = ?$
14. $\$10 \div \$160 = ?$
15. $\$1.32 \div \$2.40 = ?$
16. $\$75 \div \$2000 = ?$
17. 80 lb. $\div$ 2000 lb. $= ?$
18. 36 yd. $\div$ 1800 yd. $= ?$
19. 5 hr. $\div$ 50 hr. $= ?$

20. A man worth $15,000 lost $300 in a speculation. What per cent of his money did he lose?

III. *When a factor is less than* 1, *the product is less than the other factor.*

21. $\frac{1}{2}$ of $18 = ?$
22. $\frac{2}{3}$ of $9 = ?$
23. $\frac{3}{4}$ of $12 = ?$
24. .25 of $48 = ?$
25. .72 of $\$60 = ?$
26. .17 of $\$250 = ?$
27. 35% of $\$32 = ?$
28. 64% of 50 T. $= ?$
29. 22% of 19,500 $= ?$

30. A farm worth $14,500 rents for 5% of its value. What is the rent?

Problems

1. Find 12% of $75.

2. 35 yd. is what per cent of 105 yd.?

3. Of a farm of 160 A. 45% is wood lot. How many acres of wood lot are there?

4. In a baseball game Fred's team scored 14 runs of which Fred made 2. What per cent of the 14 runs did Fred make?

5. At an election 8% of the votes in a certain district were spoiled. There were 425 votes cast. How many were spoiled?

6. If $3\frac{1}{2}\%$ of Jersey milk is butter fat, how many pounds of butter fat would there be in 85 lb. of milk?

7. A teacher who earns $1750 a year saves $525. What per cent of her salary does she save?

8. In a city of 18,000 population 22% of the people are in school. There are how many in school?

9. 10 min. is what per cent of an hour?

10. Mr. Granger earned $3696 in one year and saved 14% of it. How much did he save?

11. A collector started out with bills amounting to $840. He collected $735. What per cent of the bills did he collect?

12. If you have $234 in the bank and check out 32% of it, how much do you check out?

13. Mr. Smith pays $150 a year for fuel. That is what per cent of his salary of $3000?

14. A boy weighing 125 lb. gained 16% in one year. How many pounds did he gain?

15. Edith had seven examples right. There were eight in the lesson. What per cent did she have right?

16. Mr. Smithers had a salary of $2800. It was increased 15%. How many dollars was the increase?

17. In a class of 40 pupils there were 22 boys. What per cent of the pupils were boys?

18. Mr. Dykes owed a debt of $2200 on which he made a payment of 32%. How much was the payment?

19. $16 is what per cent of $20? $20 is what per cent of $16?

20. A city of 171,000 gained 15% in population. What was the gain?

21. Dr. Trapp bought an automobile for $1568 and sold it at a reduction of 18%. How much was the reduction?

22. Of 75 papers Frank sold 60. What per cent remained unsold?

23. Coal which sold at $11.50 per ton increased 12% in price. What was the amount of the increase?

24. How many feet are there in 12% of a mile?

25. Henry's bicycle cost $42. He sold it for 85% of its cost. What did he get for it?

26. A farmer expected a crop of 350 bu. of potatoes. The crop was 14% more than his estimate. How many bushels were there?

27. Thomas saved $128, then spent 23% of it for a suit of clothes. What did the suit cost?

28. In the drug store Henry saw a bottle which had these two statements on the label —

"Net contents 16 oz."
"Alcohol 25%."

How many ounces of alcohol were there in the bottle?

29. Out of 80 words in a spelling test, Charlie missed 4. What per cent did he miss? What per cent did he spell correctly?

30. During a storm 8% of a cargo of 9200 bbl. of sugar were thrown overboard. How many barrels were thrown overboard?

31. A motor truck weighing 3200 lb. can carry a load of 2800 lb. The weight of the truck alone is what per cent of the weight of the load it can carry?

32. Harry is in school 32 hr. a week. Of this time he recites 15 hr. What per cent of his time is he reciting?

33. In a school system of 24,300 pupils 93% passed at the end of the term. How many pupils passed?

34. If a pine plank weighs 45 lb. and an oak plank of the same size weighs 72 lb., the weight of the pine is what per cent of the weight of the oak?

35. A grocer bought 100 lb. of soda for $3.50 and sold if for $142\frac{8}{7}\%$ of its cost. What did he receive a pound for it?

36. Make and solve a problem about $420 and 35%.

37. Make and solve a problem about $324 and 6%.

38. One pint is what per cent of a gallon?

39. One quart is what per cent of a gallon?

40. One peck is what per cent of a bushel?

41. One foot is what per cent of a yard?

42. What per cent of a peck is one quart?

Complete the following statements:

43. To find 25% of a number, take —— of the number.

44. To find 17% of a number, change 17% to hundredths and ——.

45. To find 200% of a number, think 200% is the same as —— and ——.

46. To find 119% of a number, change 119% to —— and multiply.

Increase and Decrease

Optional

1. What number increased by 10% of itself equals 220?

It is evident that 220 is 10% + 100% of the required number, or 110% of it. Then the question becomes, 110% of ? = 220.

2. A clerk's salary was increased 20%, making his salary $1200. What was his salary before the increase?

3. John has $3.72, which is 20% more than James has. How much has James?

4. What number increased by 25% of itself is $1050?

5. A school this year has 750 pupils, which is 50% more than it had last year. How many pupils did it have last year?

6. What number diminished by 20% of itself equals $640?

640 lacks 20% of being the original number, therefore it is 100% − 20%, or 80% of the original number.

7. 1170 is 10% less than what number?

8. After withdrawing 30% of my money from the bank, I still have $1400 on deposit. How much had I at first?

9. A city lot costs $2000, which is 60% less than the house costs. What does the house cost?

10. 20% of a regiment of soldiers are sick, leaving 2200 of them able to do duty. How many men are in the regiment?

11. By selling goods at $630 a merchant loses $12\frac{1}{2}$% of the cost. What was the cost?

12. A merchant sold goods for $25.65. This was 10% less than the marked price. What was the marked price?

What number increased by:

13. 10% of itself = 220?
14. 35% of itself = 810?
15. 75% of itself = 1750?
16. 100% of itself = 600?

What number diminished by:

17. 10% of itself = 90?
18. 17% of itself = 415?
19. 75% of itself = 1000?
20. 99% of itself = 100?

21. In one year a merchant's profits were $1800.00. This was 20% greater than the year before. What were the profits the year before?

22. Having spent 40% of my money, I had $12 left. How much money had I at first?

23. A boy sold $66\frac{2}{3}$% of his chickens and kept 20 chickens. How many had he at first?

24. A soldier after spending a month in camp found that his weight, 168 lb., was 5% greater than when he enlisted. What was his weight when he enlisted?

25. Raymond has shoveled 25% of his walk, and will not finish till he has shoveled 45 ft. more. How many feet are there in his entire walk?

26. A merchant sold cloth for cloaks at $3.30 per yard, which is 65% more than it cost. What did it cost?

27. A merchant sold baseball suits at $7.60 each, at a reduction of 20%. What was the original price?

28. An engineer saves $80 a month, after using 60% of his wages for living expenses. What does he earn?

29. A manufacturer received 1600 lb. of yarn. This lacked 20% of filling his order. How many pounds did he order?

30. Mr. Wallace sold 80% of his crop of apples for $4000. What was the value of the entire crop at that rate?

Commission

1. Mr. Morgan received \$50 for selling \$1000 worth of property for Mr. Jones. This sum is called *commission.* How much would Mr. Morgan receive for selling \$2000 worth at the same rate?

2. A man received a commission of \$10 for selling a set of books. How much commission would he receive for selling 8 sets of these books?

3. A real estate dealer received a commission of \$120 for selling a house. How much commission would he receive for selling 3 houses of the same value?

4. A lawyer received a commission of \$15 for collecting \$175. How much commission would he receive for collecting \$525?

5. An auctioneer received a commission of \$75 for selling \$750 worth of furniture. How much commission would he receive for selling \$1500 worth?

An **agent** is a person who does business for another party.

The **principal** is the party who employs the agent.

Commission is the amount paid an agent for his services. This amount is usually stated in one of two ways. It can be a definite sum of money or it can be a per cent of the money involved in the transaction.

6. When selling newspapers, the rate of commission is usually expressed as a definite sum of money. When I receive 1 cent for the sale of a three-cent newspaper, what part or per cent of the sale do I receive?

7. An auctioneer received a commission of 10% on the sale of $1200 worth of household goods. How much money did he receive?

8. A commission merchant sold 500 pounds of butter at 30 cents a pound, retaining as his commission 8%, and sending the remainder to his principal. What did he receive for his commission? How much did the principal receive?

9. An agent received $100 for selling $2000 worth of goods. What is his rate of commission?

10. What is an architect's commission at 5% on a school building costing $175,000?

11. A collector received 10% commission for collecting a debt of $4200 for his principal. What was his commission?

12. What was the amount of an agent's commission if he received 8% for selling $1500 worth of goods?

13. Find the commissions for the following amounts using the per cents at the top of the column for the rate of commission.

5%	10%	$12\frac{1}{2}\%$	$33\frac{1}{3}\%$
14. 40¢	21. $50	28. $800	35. $300
15. 60¢	22. $100	29. $400	36. $30
16. $1.00	23. $500	30. $1600	37. $9
17. $2.00	24. $1000	31. $2400	38. $900
18. $2.40	25. $1200	32. $64	39. $90
19. $9.80	26. $94	33. $960	40. 90¢
20. $12	27. $865	34. $3.20	41. $660

The **consignment** is the goods delivered to the agent to be sold.

The **consignor** is the party sending a consignment of goods to be sold by the commission agent.

The **consignee** is the party to whom a consignment of goods is delivered for sale.

The **proceeds of sales** is the sum received from the sale of goods, after all expenses, such as commission, freight, and cartage, have been deducted.

1. A commission merchant sold a consignment of goods for $2500, took out his commission of 10%, paid $50 freight and $10 for storage and sent the remainder to the consignor. What was the commission? How much did the consignor receive?

2. An agent received 5% for buying wool at 20¢ a pound. What was his commission on 10 tons of wool?

3. What is an agent's rate of commission if he receives $200 for buying produce valued at $4000?

4. A rent collector's commission is 4%. If he collects $4000 a month, how much does he receive? How much does he pay over to the owners?

Sales	Rate of Commission	Commission	Proceeds
$1200	5%	?	?
$900	10%	?	?
$800	7%	?	?
$75	2%	?	?
$92	4%	?	?

5. What is an agent's commission for selling 6840 lb. of butter at 35 cents a pound, commission 2%? How much money will the consignor receive?

6. A commission merchant gets 2¢ a dozen for selling a consignment of 120 dozen eggs at 60 cents a dozen. What is his commission? How much does the consignor receive?

7. An agent received from his principal a consignment of furniture valued at $3000. If 8% is deducted for commission, $100 for freight, and $50 for cartage, how much does the consignor receive?

8. A fruit-selling agency charged 25¢ a box for selling apples. What was the commission on 2500 boxes sold at $1.25 a box? How much does the consignor receive?

9. An agent is paid $368 for selling $3600 worth of hardware. What is the rate of commission?

10. An agent's commission for selling 479 books at $3.50 apiece was $670.60. Find the rate of commission.

11. An agent received from his principal 850 barrels of flour, which he sold at $7.25 a barrel. How much did he receive for commission if his rate was $4\frac{1}{2}\%$? How much did the consignor receive?

12. A real estate agent sold a farm for $8000, receiving 5% commission. How much was left the owner?

13. Find the proceeds of sale on 2000 pounds of lard at 25 cents a pound. Cartage and storage are $40, the commission is 5%.

14. Make a problem in commission for the class to solve. Explain the reason for the rate of commission which you have given.

15. Secure an actual rate of commission from a person in your town.

Profit and Loss

The same rules of percentage that have been used on the preceding pages are followed in business problems where there is either a profit or a loss.

To obtain the profit or the loss, the cost and the rate per cent are multiplied. The profit is, therefore, a product of these two factors.

This product (profit or loss) divided by either of these two factors (rate or cost) gives the other factor.

Gain or loss is figured in per cent, usually on the cost price.

Rent, cost of shipment, insurance, etc., are considered as part of the cost.

The per cent of gain may be expressed in several ways. "A 15% gain," "15% above cost," "a profit of 15%," "an advance of 15%," all mean that the gain is 15%.

Given rate and cost, to find the profit (or loss):

1. 5% of \$100
2. 10% of \$70
3. $12\frac{1}{2}\%$ of \$750
4. 4% of \$150
5. 25% of \$640
6. 75% of \$16

Profit (or loss) and cost given, to find the rate:

7. ? per cent of \$60 = \$6
8. ? per cent of \$90 = \$10
9. ? per cent of \$16 = \$4
10. \$25 = ? per cent of \$75
11. \$75 = ? per cent of \$100
12. \$15 = ? per cent of \$60

Profit (or loss) and rate given, to find the cost:

13. 50% of ? = \$25
14. 10% of ? = \$10
15. 20% of ? = \$18
16. $12\frac{1}{2}\%$ of ? = \$7
17. $33\frac{1}{3}\%$ of ? = \$15
18. 5% of ? = \$60
19. 15% of ? = \$100
20. $16\frac{2}{3}\%$ of ? = \$40
21. 30% of ? = \$240
22. 40% of ? = \$160

23. Mr. Hagord, a plumber, gained 10% on a contract that cost him $2400. How many dollars did he gain?

$$10\% \text{ of } \$2400 = ? \quad \tfrac{1}{10} \text{ of } \$2400 = ?$$

24. A real estate dealer bought a city lot for $2750 and sold it at a gain of 20%. How much did he receive for the lot?

25. A stock of fruit costing $400 was damaged by shipment 40% of its value. What was the loss?

$$40\% \text{ of } 400 = ?$$

26. If a merchant sells goods for $30, which cost him $24, how much is his profit? What per cent of the cost does he gain?

$$\$30 - \$24 = 6. \quad \tfrac{6}{24} = \tfrac{1}{4} \text{ or } 25\%.$$

27. A hat which cost $5 was sold at a margin of 10%. Find the selling price.

28. Mr. Morrow gained $12\frac{1}{2}\%$ on a building contract that cost him $72,000. How much did he gain?

29. What per cent is made on a chair which cost $16 and is sold for $20?

30. Silk that cost $3 a yard is sold for $2 a yard. What per cent of the cost is lost?

$$\$3 - \$2 = \$1. \quad \tfrac{1}{3} = 33\tfrac{1}{3}\%.$$

31. A candy dealer bought chocolate for 60 cents a pound and sold it at 90 cents a pound. What per cent was the profit on this sale?

32. A stock of men's clothing costing $2400 was damaged 60% of its value by fire. What was the loss to the merchant?

33. A dealer in farm machinery gained 20% by selling a mower for $30 more than he paid for it. Find its cost.

34. Mr. Donovan lost 18% by selling groceries for $180 less than cost. What was the cost? What was the selling price?

35. A butcher bought beefsteak at 30¢ a pound and sold it at 40¢ a pound. What was the gain on a pound? What per cent of the cost was gained?

36. Mr. Black sold a piano at a profit of 35% thereby gaining $87.50. What was the cost of the piano?

37. A merchant lost $300 by selling goods damaged by fire, at a loss of 30%. What was the cost? What was the selling price?

38. A grocer bought potatoes at 75¢ a bushel and sold them at $1 a bushel. What per cent did he gain?

39. A hardware merchant bought 125 hundred-pound kegs of nails for $437.50. If he sells the nails at 4¢ a pound, does he gain or lose? What per cent does he gain or lose?

40. A furniture dealer sells a dining room set for $400, gaining 25% thereby. Find the cost.

41. A dealer gained 10¢ by selling binding cord for 20% above cost. What did it cost him?

42. A women's furnisher sells a fur coat for $480, gaining $80. What did the coat cost? What per cent is gained?

Cost	Rate of Gain	$ Gain	Selling Price
$ 500	10%	?	
$1200		?	$1600
$ 640	$33\frac{1}{3}$%		?
$ 480	20%		?

43. A shoe dealer sold a bill of goods costing \$600 and lost \$24 in debts, but made a net profit of 26% in the sale. At what price did he sell?

44. A confectioner bought goods for \$1200 and sold them at an advance of 40%. What was the selling price? What was the profit?

45. A horse dealer paid \$3750 for 25 horses. He sold 15 of them at \$140 per head and the rest at \$210 per head. What per cent of profit did he make?

46. A street huckster buys sweet corn at \$2 per hundred ears and sells it at 36¢ a dozen. What per cent profit does he make?

47. Frank sold his skates for \$1.20, which was 25% less than they cost. How much did they cost?

100% of the cost less 25% of the cost = what per cent of the cost?

STATEMENT: 75% of the cost is \$120

.75 × ? = \$1.20

48. On an article which cost \$190, the dealer lost 10%. What was the selling price? How much was lost?

49. Mr. Murphy sold his city lot for \$1200, losing 20%. What was the cost and how much did he lose?

50. A horse speculator bought a span of horses for \$220 each. He sold one at a gain of 15% and the other at a loss of 15%. What were the selling prices?

51. A dry goods merchant bought cloth at 16¢ a yard and sold it at 20¢ a yard. What per cent did he gain?

52. A cotton dealer bought a shipment of cotton for \$4800, and sold it for \$3600. What per cent did he lose on this transaction?

53. A farmer sold his farm at $80 an acre, gaining thereby 20%. What price per acre did he pay?

54. A man sold his automobile for $1200, which was a decrease of 40%. Find the cost of the automobile and the loss.

55. A real estate dealer sold a city lot for $2500. The increase was 25%. Find the cost.

56. A produce dealer sold potatoes at $2.50 a barrel, his profit being $12\frac{1}{2}\%$. What did they cost per barrel?

57. In a city department store $2,800,000 was paid for goods in one year. If they were sold at 20% increase, what were the profits?

58. By selling flour at a loss of 20%, a grocer lost $36. What was the cost of the flour? What was the selling price?

59. Selling goods at $2000 gives a merchant a profit of 25%. What is his profit?

60. A shoe dealer sold a bill of goods for $600, gaining 15%. Find his gain.

61. A merchant sold an article for $3.60, an increase of 20%. What was the cost? What was the increase?

62. A farmer sold a cow for $120, gaining $20. What was the cost of the cow?

Complete the following problems:

63. The cost is $500. The rate of gain is 25%. Find the ——.

64. In selling candy which costs 8 cents a box for 10 cents, what is the per cent of profit on the ——?

65. Make a problem in profit and loss for the class to solve.

Interest

1. Mr. Roberts lives in a house which is owned by Mr. Snow. Every month he pays Mr. Snow $30. This sum is called *rent*. How much rent will Mr. Roberts pay in two months?

2. Mr. Snow owns four houses which he rents for $30 a month each. How much rent does he collect every month?

3. Mr. Smith who rents a house for $40 a month pays his rent once every three months. How much does he pay each time?

4. Suppose you own two houses which you rent for $30 each. How much rent would you collect in two months? In three months?

5. Harry Bennett hired a canoe at the lake at the rate of 25 cents an hour. He kept it 3 hours. How much did he have to pay?

6. Mrs. Gordon rented a typewriter for four months at $3.25 a month. How much did she have to pay for using the typewriter for four months?

7. Mr. Williams borrowed $100 from Mr. Robinson, and after using it a year returned it, and in addition paid Mr. Robinson $6 for its use. This is called interest. How much interest would he have paid had he borrowed $200?

8. At the rate of $6 for the use of $100 for one year how much should I pay for the loan of $200 for 2 yr.?

9. At the rate of $5 for the use of $100 for one year, what part of the $100 is paid for its use? This part is usually expressed as per cent. This per cent is called the rate of interest.

10. What rate of interest is used when $6 is paid for the use of $100 for one year?

Interest *is money paid for the use of money.*

Principal *is money for the use of which interest is paid.*

Rate *is the per cent of the principal taken as interest for one year.*

Amount *is the sum of principal and interest.*

1. Mr. Smith borrowed \$400 for one year at 6%. How much interest will he have to pay?

2. Mr. Andrews owes Mr. Perkins \$1000 with interest for 1 year at 6%. What amount does he owe?

3. On Mr. Scott's house there is a mortgage of \$2000 bearing interest at 5%. What interest must he pay annually?

4. Suppose you borrowed \$100 from your father for 1 yr. with interest at 6%. How much interest should you pay?

5. If you were to borrow \$400 for 1 yr. with interest at 6%, what would the interest be?

6. If you borrow \$400 for 2 yr. with interest at 6% how much would the interest be?

7. What is the interest on:

a. \$100 for 1 yr. at 6%?
b. \$200 for 1 yr. at 6%?
c. \$100 for 2 yr. at 6%?
d. \$200 for 2 yr. at 6%?
e. \$100 for 1 yr. at 4%?
f. \$200 for 2 yr. at 4%?
g. \$300 for 1 yr. at 5%?
h. \$400 for 1 yr. at $4\frac{1}{4}$%?
i. \$800 for 2 yr. at 5%?
j. \$200 for 1 yr. at $4\frac{1}{2}$%?
k. \$500 for 1 yr. at $5\frac{1}{2}$%?

Oral

Find the interest for 1 *yr. at* 6% *on :*

1. \$100	**5.** \$600	**9.** \$1200	**13.** \$50
2. \$200	**6.** \$500	**10.** \$1500	**14.** \$150
3. \$300	**7.** \$800	**11.** \$900	**15.** \$250
4. \$400	**8.** \$700	**12.** \$1100	**16.** \$350

In examples 1–16 find the interest at 4%; at 5%.

What is the interest on \$100 *for* 1 *yr. at:*

17. 4%? **18.** 6%? **19.** 3%? **20.** 5%?

In examples 17–20 find the interest on \$200, \$300, \$600.

Find the interest on :

21. \$200 at 6% for 2 yr.	**26.** \$800 at 4% for 1 yr.
22. \$300 at 4% for 3 yr.	**27.** \$500 at 6% for 2 yr.
23. \$500 at 5% for 1 yr.	**28.** \$400 at 4% for 4 yr.
24. \$400 at 4% for 2 yr.	**29.** \$200 at 5% for 3 yr.
25. \$700 at 3% for 3 yr.	**30.** \$300 at 3% for 4 yr.

Written

31. What is the interest on \$724 for 2 yr. at 6%?

\$724 *Principal*
.06 *Rate*
\$43.44 *Interest for* 1 *yr.*
2
\$86.88 *Interest for* 2 *yr.*

The **interest** *is the product of three factors;* viz., *the principal, the rate, and the number of years.*

32. Find the interest on \$824 for 3 yr. at 4%.

33. Find the interest on \$165 for 2 yr. at 5%.

34. What is the interest on \$1248 for 1 yr. at 6%?

Find the interest on:

1. \$650 for 1 yr. at 6%.
2. \$380 for 1 yr. at 6%.
3. \$725 for 1 yr. at 6%.
4. \$232 for 1 yr. at 6%.
5. \$985 for 1 yr. at 6%.
6. \$324 for 1 yr. at 6%.
7. \$520 for 1 yr. at 6%.
8. \$840 for 1 yr. at 6%.
9. \$436 for 1 yr. at 6%.
10. \$1346 for 1 yr. at 6%.
11. \$925 for 1 yr. at 4%.
12. \$1052 for 2 yr. at 4%.
13. \$3000 for 4 yr. at 4%.
14. \$850 for 3 yr. at 5%.
15. \$1200 for 6 yr. at 5%.
16. \$792 for 2 yr. at 5%.
17. \$286 for 5 yr. at 6%.
18. \$1572 for 3 yr. at 6%.
19. \$2840 for 2 yr. at 3%.
20. \$3624 for 2 yr. at 5%.

21. Mr. Henderson borrowed \$2400 for 2 yr. at 6%. What interest did he have to pay?

22. Mr. Smith owes Mr. Shingle \$1245 Jan. 1, 1926, with interest for 1 yr. at 6%. What amount must he pay Mr. Shingle to settle his debt?

23. The mortgage on Mr. Carver's farm became due July 1, 1925. It was for \$1100 with interest for 1 year at 5%. How much did Mr. Carver have to pay to settle the mortgage?

24. Mr. Barclay borrowed \$152 from me for a year at 5%. How much may I expect him to pay me when the debt becomes due?

	Rate	Principal	Time	Interest
25.	4%	\$ 246	2 yr.	?
26.	5%	\$ 60	1 yr.	?
27.	$5\frac{1}{2}$%	\$1600	2 yr.	?
28.	6%	\$ 420	1 yr.	?
29.	$4\frac{1}{4}$%	\$ 840	1 yr.	?

Trade Discount

Any reduction or allowance on an account, a debt, or a price is a discount.

Trade discount is a reduction from the list price allowed to the purchaser.

A price list is a published list of prices of articles for sale.

The list price is the price given in a price list.

A discount for cash payment is sometimes called a *cash discount.* In the trade a cash discount is usually made in consideration of the payment of a bill within a certain time, the terms being stated in the bill. A discount because of the quantity of goods sold is sometimes called a *quantity discount.*

A 10% reduction from a price is called " a 10% discount, 10% off, or $\frac{1}{10}$ off."

The total amount charged in a bill is the **gross amount.**

The gross amount less all discounts is the **net amount** or **net price.**

When two or more discounts are made from the price of an article, they are called **successive discounts.**

Find the discount on each of these list prices at the rate placed above each column :

10%		25%		$33\frac{1}{3}$%		5%		$12\frac{1}{2}$%	
1.	$2.00	6.	$40	11.	$30	16.	40¢	21.	$16
2.	$5.00	7.	$60	12.	$15	17.	80¢	22.	$24
3.	$8.00	8.	$80	13.	$45	18.	20¢	23.	$64
4.	$11.00	9.	$100	14.	$60	19.	$1.00	24.	$96
5.	$50.00	10.	$1000	15.	$1.20	20.	$2.00	25.	$80

26. A table listed at $88 is sold at a discount of $12\frac{1}{2}$%. What was the selling price?

27. George's father purchased a car listed at $800 at a discount of 20%. What did the car cost him?

Problems

1. The whole of anything is what per cent of it?

2. When an article is sold at a discount of 10% from the list price of $110, it is sold for what price?

3. I bought Longfellow's poems listed at $1.50, the bookseller allowing me 20% off. How much did I pay?

4. I can buy a bicycle for $40 and pay for it in 30 days, or obtain a discount of 2% by paying cash. How much will I save by paying cash? What is the cash price?

5. A man bought a bill of goods at 10% discount. He paid $180 for them. What per cent of the list price did he pay? What was the list price?

6. By paying cash for a bill of goods I obtained a discount of 2%. The bill amounted to $120. What was the amount of money saved?

7. A merchant bought from a jobber goods listed at $2000, receiving a discount of 40%. What was the entire discount? What did he pay for the goods?

8. A merchant bought a bill of goods at $\frac{1}{3}$ off. What was the discount on goods listed at $90? What was the net price?

9. What is the net price of goods listed at $200 and bought at a discount of 30%? What is the discount?

10. The list price of a bill of goods is $12. The rate of discount is 40%. What is the net price? What is the discount?

11. Bring advertisements showing the list price of articles and the reduction offered.

Optional

1. Goods listed at \$3241 are sold at a discount of 30%. What is the discount? 30% of \$3241 = ?

2. Goods listed at \$3241 are sold at a discount of 30%. What is the net price? 70% of \$3241 = ?

3. What is the discount on a catcher's mitt listed at \$7.20, $\frac{1}{10}$ off?

4. Find the net price of bacon listed at 40¢ a pound, less $\frac{1}{5}$.

5. A snare drum was marked \$9.60 but was sold at $12\frac{1}{2}\%$ discount. What was the sale, or net price?

6–10. *Find the discount :* 11–15. *Find the net price :*

List Price	Rate of Discount	Discount	List Price	Rate of Discount	Net Price
\$ 50	40%		\$ 40	20%	
\$260	25%		\$ 60	25%	
\$590	$33\frac{1}{3}\%$		\$230	$37\frac{1}{2}\%$	
\$475	20%		\$500	40%	
\$340	16%		\$640	18%	

16. I bought a chair at a sale for \$6.40, at a discount of 20%. What was the list price? 80% of ? = 6.40

17. A man bought goods at 15% discount. What was the list price of goods that cost him \$59.50?

18. The net price of a purchase of stationery at $\frac{1}{10}$ off was \$4.50. What was the list price?

19. Net price, \$1.28, rate of discount, 20%. What is the list price?

20. When goods are selling $\frac{1}{4}$ off from list price, what is the list price of a purchase of \$1.50?

21. Miss Geyer paid cash for goods, and was allowed a 2% discount. She saved \$1.80 by paying cash. What was the amount of her purchase? 2% of ? = \$1.80

22. A merchant saved \$4.50 by paying cash, thus obtaining a discount of $1\frac{1}{2}\%$ on a bill of goods. What was the amount of the bill?

23. Mr. J. J. Hogan could buy a bill of furniture for \$520 on credit, or at 5% off for cash. What was the cash price?

24. A fruit merchant sold me ten barrels of apples at \$2.50 a barrel. They arrived in poor condition and he discounted the bill 20%. How much did I pay?

25. The list price of baseball suits is \$4.75 apiece. Our team needs 11 suits. How much must we pay for them at 20% discount?

26. A suit marked \$48 was sold late in the season for \$40. The reduction was what per cent of the marked price?

27. Mr. Johnson's store caught fire, and his goods were damaged by smoke and water, so that he sold them at 65% below cost. What did he receive for 38 yd. of lace that cost \$.25 a yard? What was the cost of a coat that sold for \$7? How much did he lose on a table that cost \$15?

28. I saw straw hats in a window marked as follows: \$1.50, \$4.50, \$1.20, \$2.70, \$2.25. How much would be taken off from the price of each one if they were marked down $33\frac{1}{3}\%$?

29. \$2 union suits are marked down 25%. At what price are they sold?

30. How much do I save on a \$30 overcoat by waiting until it is marked down $16\frac{2}{3}\%$?

31. What per cent is the reduction when women's handbags, marked \$1.20, are sold at \$1.00?

32. A 5% discount on a set of Mark Twain's works amounts to \$1.60. What is the list price?

ANALYSIS

1. Most of us can solve a problem easily when it requires only one process, such as addition, subtraction, multiplication, or division. Where only one process, or step, is required, we are usually given two facts from which to find a third, which is the answer. For example, Frank earned 75¢ a day. He worked 5 days. These are the two facts that are given. From them we may find a third fact. What is it?

2. When more than one step is required, we may have two facts given, but we cannot obtain the answer until we find another fact and use that to find the answer. For example, we may be asked to find the number of tons in two loads of coal weighing 5321 lb. and 4679 lb. We cannot find the answer by one operation. If we were given the number of tons in each load, instead of the number of pounds, we could add them to find the whole number of tons; or if we were given the whole number of pounds, we could remember that there are 2000 lb. in a ton and then get the answer by one operation. So we may do either of two things to obtain another fact that we need to get the answer. Which will be easier? Try it.

Sometimes it will help us decide what to do if we think, "Will the answer be greater or less than the number given?" or, "What must I find before I can use one of the given facts to get the answer?"

3. Sugar is 8¢ a pound. Louis bought 10 lb. Question.

4. A pane of glass is 16 inches long. What other fact must we have before we can find its area?

5. Dan paid $2.25 for some stockings. What other fact must we have to find the number of pairs he bought?

6. A clerk gave Henry 76¢ in change. What other facts must we know to be sure the change is correct?

7. Fred worked last Saturday for 10¢ an hour. What other fact must we have in order to find how much he earned?

8. Three girls made bandages for the Red Cross. The first made 45 bandages, and the second made 61 bandages. What must we know before we can find how many bandages were made by the three girls?

9. Ruby's brother earns $80 a month. He spends $48.35 a month. We are to find what he saves in two years. What must we find first? In how many ways may we solve this problem?

10. Edgar went to the store with a $5 note. He bought potatoes, flour, a broom, some cans of corn. What more must we know in order to find what change he should receive?

11. A concrete sidewalk is 200 ft. long. What else must we know in order to find its area? What other fact must we still have before we can find its cost?

12. A floor contains 240 sq. ft. This and what other number would enable you to find its length? The area and what other number would enable you to find its width?

13. A soldier receives $30 a month. What else must you know in order to find what he has received since he entered the army?

14. We know the cost of 15 pounds of sugar. How may we find the cost of 30 pounds? Of 45 pounds? Of 3 pounds? Of 5 pounds?

15. A number of girls shared equally the cost of a picnic lunch, consisting of fruit, jelly, cake, sandwiches and lemonade. How shall we find each girl's part of the expense?

HOME PROBLEMS

1. Frances makes ice cream, using the following materials. Find the total cost.

2 eggs at 30¢ a dozen
4 half-pint cups of milk at 10¢ a quart
1 half-pint cup of cream at 60¢ a quart
1 spoonful of vanilla extract, 1 cent
¼ lb. sugar at 7¢ per pound
10 lb. of ice at 60¢ per 100 lb.
2½ lb. of salt at 60¢ for a 50-lb. sack

2. The above recipe will make 1½ qt. of ice cream. How much would 3 qt. cost at the same rate?

3. Helen received a camera as a birthday gift, and learned to take pictures. She also received $2.50 with which to buy necessary materials for developing and printing. How much had she left after buying:

1 printing frame, 25¢
1 red candle lamp, 25¢
4 developing trays, 10¢ each
2 films, 30¢ each
2 packages printing paper, 20¢ a package
½ doz. developing powders, 60¢ a dozen
½ lb. acid fixing powder, 48¢ per pound

4. Helen made four pictures of Wilson and Sandy, using:

⅓ of 1 film
½ package of printing paper
1 developing powder
1 oz. acid fixing powder

What did they cost?

5. She could have made a dozen pictures with no additional expense except another half package of printing paper. How much apiece would the pictures have cost?

Henry was invited to his uncle's camp in the Adirondack Mountains for a two weeks' vacation and fishing trip. He had saved $20 from his earnings on Saturdays during the school year.

1. With a part of this money he purchased:
   1 Paragon bait rod, $2.50
   1 multiplying reel, $1.40
   1 enameled silk line, $.90
   3 doz. snelled hooks at $.35 per dozen
   1 canvas hook and tackle book, $.50
   1 willow trout basket, $1.10
   How much did these articles cost?

2. What was the amount of his railroad fare for 98 miles at $2\frac{1}{2}¢$ per mile?

3. He paid $.75 for a six-mile ride in a buckboard wagon from the station to his uncle's camp. Find the rate per mile.

4. Henry and his uncle went trout fishing eight times. Their catches for the different trips weighed as follows: 3 lb. 5 oz., 2 lb. 5 oz., 7 lb. 4 oz., 1 lb. 12 oz., 2 lb. 2 oz., 5 lb. 4 oz., 10 oz., 4 lb. 8 oz. What was the total weight?

5. If the weight of the trout averaged 7 oz. apiece, how many did they catch?

PRACTICE EXERCISES FOR ALL GRADES

These exercises are intended for development of speed and accuracy. Make a reasonable time standard for the class, for each exercise, and let each pupil go on to the next exercise as soon as he has reached that standard. Study the difficulties of individuals and suggest helpful methods.

Add:

1.	24	32	49	63	75	68	85	67
	8	9	4	8	6	9	7	7
2.	4	8	15	68	38	37	24	47
	0	6	18	75	65	92	37	69
	3	9	19	91	72	48	63	35
	7	4	34	42	91	36	8	72
	5	3	43	80	86	75	92	84

Subtract:

3.	47	53	61	23	35	43	72	53
	9	8	4	7	8	6	9	8

4.	6384	8032	2006	5980
	705	591	307	4938

Multiply:

5.	3856	2479	8254	7065
	95	63	403	893
6.	7965	4821	3874	6348
	234	806	259	219

Divide:

7. $28\overline{)8934}$ $67\overline{)3942}$ $85\overline{)7863}$ $86\overline{)39428}$

8. $293\overline{)68754}$ $409\overline{)397648}$ $534\overline{)3920759}$

Add:

9.

2	1	9	7	8	2	1	2
3	8	2	3	1	1	9	1
5	3	1	2	9	8	2	3
1	0	3	1	3	5	4	4
0	9	5	4	4	4	2	5
4	7	0	5	6	9	6	1
6	6	4	6	2	1	5	6
2	3	3	7	9	3	4	9
8	4	6	2	1	7	4	8

10.

4	8	7	3	3	3	8	9
3	7	3	0	8	8	6	9
2	5	4	9	2	4	3	0
9	4	6	5	4	7	2	0
7	3	7	1	1	2	4	6
5	6	2	2	7	0	7	6
4	7	4	6	5	9	9	8
1	4	8	4	5	9	3	2
2	9	6	7	9	1	4	6

11.

37	87	91	52	33
63	96	28	48	48
48	42	34	39	79
91	83	63	91	22
86	79	79	28	46
23	21	81	64	89
79	43	40	79	70
61	70	86	81	39

Subtract:

12. 28314 — 9294

803427 — 56138

923415 — 607436

Add:

13.

7	3	7	2	8	2	3
6	2	1	4	3	8	7
3	5	6	9	2	9	4
1	0	8	3	4	1	9
2	7	3	8	9	4	0
0	9	4	7	1	0	3
5	4	2	6	6	7	6
9	6	7	5	8	6	0
8	8	9	4	7	3	5
4	2	1	1	2	7	1
2	1	6	2	4	1	8
1	5	0	3	5	8	6
8	9	9	7	1	5	9

14.

4	8	2	4	8	2	3
2	4	8	8	7	9	7
3	2	0	9	6	8	8
0	7	1	1	3	3	9
9	9	8	7	4	4	4
8	6	5	6	7	7	0
0	4	9	4	9	6	5
2	8	4	3	2	8	1
6	3	6	2	1	4	2
8	7	8	5	8	5	8
5	9	3	1	6	3	6
9	4	1	0	9	1	9
1	1	2	9	5	1	2

Divide:

15. $8\overline{)326880}$ $9\overline{)723663}$ $7\overline{)4671688}$

16. $89\overline{)348435}$ $37\overline{)110482}$ $91\overline{)2170486}$

Subtract:

17.	2482	42567	357903	612419
	391	18648	249714	574389

Multiply:

18.	2847	9045	63751	
	29	68	29	
19.	8607	3598	48659	7651
	248	439	208	897

Find results:

20. $\$38.62 + \$49.07 + \$45 + \$1.85 + \$2.367 + \$12.486$.
21. $21.05 + 342.162 + 8.795 + 4.06 + 584.3$.
22. $\$86 - \$2.47$; $\$635 - 28.56$; $\$837.40 - \$83.74$.
23. $429.37 - 85.40$; $79.275 - 42.86$; $3.245 - .325$.
24. 65.8×7.3; 431.42×21.8; 4.37×6.08.
25. $357.5 \div 2.5$; $48.3 \div .75$; $234 \div .08$.
26. $2.48 \div 1.6$; $3.625 \div 250$; $3945 \div .15$.
27. $3.12\frac{1}{2} \times 2\frac{1}{4}$; $4.1\frac{1}{4} \times .80\frac{1}{2}$; $6.2\frac{1}{8} \times .0\frac{1}{2}$.
28. $120.1 \div .42\frac{1}{3}$; $25.19 \div 3.6\frac{2}{3}$; $1071.66 \div 4.8\frac{1}{7}$.
29. $12\frac{1}{2}\%$ of 36; $62\frac{1}{2}\%$ of 7128; $16\frac{2}{3}\%$ of \$43.74.
30. 10% of \$2356; 20% of 820; 5% of 496.
31. 15% of \$243; 25% of \$6.84; 5% of 6320.
32. $\frac{7}{8} \div \frac{21}{48}$; $\frac{2}{3} \div \frac{10}{21}$; $\frac{1}{3} \div \frac{8}{9}$; $\frac{5}{7} \div \frac{15}{49}$.
33. $\$837.42 - \$23.471$; $\$986.395 - \$342.46$.
34. $425 \div 25$; 16×25; $3900 \div 300$.

Give approximate results:

35. \$312 × 49; \$2586 ÷ 26; 987 × 27.

36. $\frac{3}{8}$ of 8165; $\frac{2}{3}$ of 6125; 73% of \$160.

Add:

37.

3856	2845	2864	9013
2491	9137	9349	2761
3072	6847	5865	5829
6586	5936	7234	5734
4973	3748	4831	1384
8421	2796	6875	1376
6395	8134	2134	4978

Multiply:

38.

18647	54391	21093	86031
3426	2866	9574	5097

Subtract:

39.

301592	194396	100765
68378	28749	99784

Divide:

40. $709\overline{)2041137}$ $1928\overline{)16906632}$

Use short methods:

41. $.33\frac{1}{3}$ of 427.41; 43640 × $.62\frac{1}{2}$.

42. $37\frac{1}{2}$% of \$9270.08; 99 × 482.

43. \$36.73 × 25; 73625 ÷ 25.

44. 829 × 99; 683 × 125; 93 × $33\frac{1}{3}$.

45. 99% of \$391; $87\frac{1}{2}$% of \$1600; $12\frac{1}{2}$% of \$7128.

46. $66\frac{2}{3}$% of \$3300; $7\frac{1}{2} \times \frac{4}{5} \times 2$; $16\frac{2}{3}$% of \$120.

47. 50% of 20,000; $37\frac{1}{2}$% of 80 pounds.

48. \$56 = $12\frac{1}{2}$% of what?

True and False Tests

Write the numbers from 1 to 10 on your paper. If the first statement is true, write "true" after number one. If it is not true, write "false," etc.

I

1. Four rods is a greater distance than 70 ft. True or false?

2. Eight is $\frac{3}{4}$ of twelve. True or false?

3. Interest is the product of the principal and the rate. True or false?

4. There are four ounces in 25% of a pound. True or false?

5. .06 of $1000 is equal to 5% of $800. True or false?

6. The gain in per cent is found by dividing the cost by the selling price. True or false?

7. A pound of sugar is heavier than a pound of crackers. True or false?

8. There are more pecks in a bushel than there are quarts in a gallon. True or false?

9. The Roman notation is more widely used than the Arabic. True or false?

10. The numerator of a proper fraction is always less than the denominator. True or false?

II

1. $62\frac{1}{2}\%$ of $800 is equal to 50% of $1000. True or false?

2. All common fractions may be written as complete decimals. True or false?

3. There are nine less square feet in a square yard than there are in a square four feet on each side. True or false?

4. The average of any five numbers is always larger than the smallest number and smaller than the largest number. True or false?

5. Three eighths of a number is less than one third of that number. True or false?

6. The numerator of a proper fraction is never less than the denominator. True or false?

7. The value of a fraction is unchanged if both the numerator and denominator are multiplied by the same number. True or false?

8. All whole numbers may be written as fractions. True or false?

9. A decimal may always be written as a common fraction. True or false?

10. One half dozen oranges at 90¢ a dozen cost less than five grapefruit at three for a quarter. True or false?

III

1. One half a ton of coal at $12.75 a ton costs less than two cords of wood at $3.20 a cord. True or false?

2. Apples at 25¢ a peck are cheaper than at 90¢ a bushel. True or false?

3. A fur coat costs less at $10 down and $2 a week for 48 weeks than at $100 cash. True or false?

4. If the numerator of a fraction is divided by .5 and the denominator is divided by $\frac{1}{2}$, the value of the fraction is not changed. True or false?

5. $\frac{3}{7}$ of 49 is equal to 21% of 100. True or false?

6. When sugar is sold at 75¢ for ten pounds, I can save $1.50 by buying 100 pounds at $6.25 per hundred. True or false?

7. An integer is always decreased when multiplied by a common fraction. True or false?

8. There are three times as many inches in a yard as there are feet in the yard. True or false?

9. One fifth of a number plus one half the number plus one third the number equals the whole number. True or false?

10. 875 cents equals $\frac{7}{8}$ of a dollar.

Mental Tests

1

1. Multiply 37.5 by 80.
2. Divide 33 by 1.1.
3. Subtract 67.5 from $87\frac{1}{2}$.
4. Add $1\frac{1}{2}$, $5\frac{1}{4}$, $2\frac{1}{2}$.
5. Add 46, 54, 9, 61.
6. Twenty-seven inches is what fractional part of a yard?
7. Find $.66\frac{2}{3}$ of 900 acres.
8. What part of a square yard is five square feet?
9. Find the cost of 12,000 brick at $30 per M.
10. What number must be added to $\frac{3}{8}$ to make $\frac{3}{4}$?

2

1. Divide 60 by 1.5.
2. Multiply 800 by .02.
3. Subtract $\frac{5}{12}$ from $\frac{5}{6}$.
4. Write .20 as per cent.
5. Write $\frac{1}{4}$ as a decimal.
6. Write $\frac{1}{4}$ as a per cent.
7. Find 50% of $100.
8. Multiply 36 by $.66\frac{2}{3}$.
9. What part of 10 is 8.75?
10. Change 288 square inches to square feet.

3

1. Find 5% of $600.
2. Write 90% as a fraction.
3. Write $\frac{7}{8}$ as a per cent.
4. A man lost 75% of his money. If he had $4000, how much did he lose?
5. How many pounds are there in 50% of a ton?
6. How many quarts are there in 75% of a gallon?
7. Multiply 62.5 by 800.
8. Find the cost of 2 lb. 12 oz. of meat at 24¢ a pound.
9. What was the price per M for pine lumber when 4000 feet cost $200?
10. Find 100% of $1000.

4

1. What is $33\frac{1}{3}$% of $600?
2. Ten is what per cent of 40?
3. Change $\frac{7}{8}$ to per cent.
4. Multiply 1200 by .02.
5. Write .375 as a fraction in lowest terms.
6. Seven is what fractional part of 35?
7. Subtract .125 from 10.
8. Divide 300 by .3.
9. One hundred is what per cent of one hundred?
10. Add $\frac{3}{5}$, $\frac{3}{10}$, 2, and $\frac{1}{5}$.

5

1. Add 98, 102, 95, and 5.
2. Subtract 34 from 66.
3. Write .075 as a per cent.
4. Nine is what per cent of 45?
5. If coal is 10% ash, how many pounds of ashes are there in one ton of coal?
6. If cabbage shrinks $12\frac{1}{2}$% in shipping, what is the shrinkage on 80 tons?
7. Find the cost of nine grapefruit at 90 cents a dozen.
8. Find the cost per M feet for hemlock lumber when 40,000 feet can be bought for $800.
9. John's standing in a spelling test was 92%. If there were 50 words in the test, how many did John miss?
10. Divide 900 by .3.

6

1. Eight is what per cent of 12?
2. Find 40% of $5000.
3. An agent's commission is 5%. Find his commission on a sale of $1000.
4. A rug costing $100 is sold at a gain of 20%. What was the selling price?
5. A house costing $6000 was sold at a loss of 10%. What was the selling price?
6. Change $\frac{1}{4}\frac{1}{4}$ to per cent.
7. Multiply .7 by 3000.
8. Subtract .27 from 9.87.
9. Add $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{5}{12}$.
10. Add 37, 43, 25, and 15.

7

1. Divide 46 by 20.
2. Multiply 36 by 25.
3. Find 200% of $40.
4. What must be added to $\frac{5}{7}$ to make $1\frac{1}{7}$?
5. Add 26, 34, 25, 15, and 3.
6. What is $\frac{1}{2}$ of $\frac{7}{8}$?
7. Change .875 to a common fraction.
8. Find $33\frac{1}{3}$% of $900.
9. Change 4800 pounds to tons.
10. Multiply 66 by $33\frac{1}{3}$.

8

1. Change 300 minutes to hours.
2. Find $12\frac{1}{2}$% of $16.
3. What part of 300% is 100%?
4. Divide 630 by 300.
5. Find $\frac{1}{4}$ of $\frac{3}{4}$.
6. Multiply 48 by 25.
7. Add 150, 100, 25, 15, and 10.
8. Write 635 in Roman.
9. $\frac{2}{3} + ? = 1\frac{1}{3}$.
10. Multiply 72 by $33\frac{1}{3}$.

9

1. Multiply 396 by $33\frac{1}{3}$.
2. Find 21% of $200.
3. Change 400 pecks to bushels.
4. Write 1927 in Roman.
5. What decimal part of 16 is 4?
6. Multiply 440 by 25.
7. Find $\frac{1}{3}$ of $\frac{2}{3}$.
8. What part of 200% is $33\frac{1}{3}$%?
9. Add 2.5, 3.5, 4.6, 3.4, and 3.
10. Divide 480 by 400.

10

1. Divide 960 by 300.
2. Multiply 1590 by $33\frac{1}{3}$.
3. What decimal part of 25 is 5?
4. Write \$1306 in words.
5. Change 900 square feet to square yards.
6. Find 34% of \$1000.
7. Multiply 1600 by 25.
8. What part of 200% is $66\frac{2}{3}$%?
9. What is $\frac{2}{3}$ of $\frac{3}{4}$?
10. Add 61, 19, 23, 17, and 8.

11

1. What decimal part of 36 is 27?
2. Change 64 ounces to pounds.
3. Find the interest on one dollar for 1 year at 6%.
4. Ten is what per cent of 40?
5. Find $\frac{1}{2}$ of 60%.
6. Fred saves \$5 of his salary of \$20 each week. What per cent of his salary does he save?
7. Which is greater, $\frac{3}{5}$ or $\frac{7}{12}$?
8. What part of 300% is $87\frac{1}{2}$%?
9. Fifteen minutes is what per cent of an hour?
10. Write \$9450 in words.

12

1. What decimal part of 40 is 15?
2. Change 500 gallons to quarts.
3. Find 325% of \$100.
4. What must be added to $87\frac{1}{2}$% to equal 800%?
5. Find the interest on \$10 for one year at 6%.
6. Three square feet is what per cent of a square yard?
7. Sixteen is what per cent of 32?
8. How many hundredths of 500 is 50?
9. Divide 3.14 by .1.
10. Change 97% to a decimal.

13

1. What decimal part of 30 is 24?
2. If four pounds of butter cost two dollars, what will 8 ounces cost?
3. Cost $200, gain 25%. Find the selling price.
4. Cost $200, loss 5%. Find the selling price.
5. Twelve is what per cent of sixty?
6. List price $80, selling price $70. Find the discount in per cent.
7. Find the interest on $100 for 1 year at 6%.
8. Change 40 bushels to pecks.
9. A dime is what per cent of a dollar?
10. Divide 100 by 8.

14

1. Three is what per cent of twelve?
2. Change five square yards to square feet.
3. How many ounces are there in 125% of a pound?
4. What decimal part of 48 is 36?
5. Subtract 10% of $200 from 50% of $100.
6. Find the interest on $500 for 1 year at 6%.
7. Twenty is what per cent of sixty?
8. Change 30 gallons to pints.
9. Divide $\frac{5}{8}$ by 2.
10. Divide 25% by 2.

15

1. A $10 chair is marked down 25%. What is the selling price?
2. Find the interest on $1000 for 1 year at 6%.
3. An auto costing $800 is sold for $1000. What per cent is gained?
4. Find the commission on a sale of $90 worth of eggs if the commission is 5%.
5. Add 64, 76, 3, and 27.
6. Subtract $\frac{3}{7}$ from $\frac{11}{14}$.
7. Multiply $\frac{8}{14}$ by $\frac{7}{16}$.
8. Find the cost of 20 gallons of oil at 25¢ a quart.
9. Find 25% of 60.
10. Divide 6 by $\frac{2}{3}$.

16

1. What is the interest on $4000 for one year at 6%?

2. The commission on the sale was 10%. If the selling price was $8500, what was the commission?

3. Find 125% of 400.

4. What part of 60% is 30%?

5. Twelve is what per cent of 36?

6. A set of dishes costing $60 is sold for $75. What is the gain per cent?

7. What is the net price when the cost is $700 and the discount is 10%?

8. Forty cents is what per cent of one dollar?

9. Subtract $4.35 from $5.

10. Multiply $1.20 by 50.

17

1. What is the net price when the list price is $50 and the discount is 50%?

2. Multiply $1.125 by 800.

3. Add $\frac{1}{5}$, $\frac{1}{4}$, $\frac{3}{10}$, and $\frac{7}{20}$.

4. What is the interest on $400 for 6 months at 6%?

5. 11 is what per cent of 55?

6. Subtract $33\frac{1}{3}$% of $90 from $100.

7. Potatoes costing $2 per hundred pounds are sold for 4¢ a pound. What is the gain per cent?

8. Eleven and one half dollars is divided equally among 23 boys. How much did each receive?

9. Change 81,000 pounds to tons.

10. An agent received 8% commission for selling a car of potatoes valued at $400. Find his commission.

18

1. What is an agent's commission on the sale of $2000 worth of cabbage if his commission is 3%?

2. Goods costing $100 are sold at 20% discount. What is the selling price?

3. Fifty cents is what per cent of two dollars?

4. Multiply $1.40 by 200.

5. Add $\frac{5}{6}$, $\frac{1}{30}$, and $\frac{3}{5}$. 6. Add 25% of \$80 to \$80.

7. Find the interest on \$1200 for 6 months at 4%.

8. Change 54 square feet to square yards.

9. One pint is what per cent of a gallon?

10. Strawberries costing \$8 per bushel are sold for 35¢ per quart. What is the gain per bushel?

19

1. Change 6.25 to per cent. 2. Subtract $\frac{7}{10}$ from $\frac{4}{5}$.

3. An agent's commission on a \$1000 sale is \$50. What is his rate of commission?

4. An auto listed at \$1200 is sold at a discount of 25%. What is the selling price?

5. Six inches is what per cent of a yard?

6. Eggs are bought at \$9 for a 30-dozen case. They are sold at cost. What is the selling price per dozen?

7. Coal costing \$10 per ton is sold so as to gain 10%. What is the selling price?

8. Divide $62\frac{1}{2}$% of \$100 by 5.

9. How many fence posts at 18 cents each can be bought for \$36?

10. What is the interest on \$2000 from Jan. 1st to July 1st at 6%?

20

1. A city block costing \$100,000 is sold at a loss of 20%. What is the selling price?

2. Divide $87\frac{1}{2}$% of \$100 by 7. 3. Change 87.5 to per cent.

4. A piano listed at \$800 is sold at a discount of 40%. What is the selling price?

5. Thirty inches is what per cent of a yard?

6. Find the interest from Oct. 1st to Jan. 1st on \$16,000 at 6%.

7. How many quarts are there in $10\frac{1}{2}$ bushels?

8. An agent's commission on a deal of \$10,000 is \$400. What per cent is his commission?

9. Lumber costing \$40 per M is sold at \$60 per M. What is the gain per cent?

10. What must be paid for two cords of wood at \$8.20 per cord?

Tests of Accomplishment

I

1. Add
   36,854
   82,703
   397,223
   285,916
   5,459,463

2. Subtract
   5,459,463
   726,990

3. Multiply 5734 by 49.

4. Divide 43,687 by 28.

5. Make a bill including heading, ruling for purchases and credits, date, etc., for the following: Dey Brothers, Syracuse, N. Y., sold to E. C. Wood, Clyde, N. Y., on Sept. 8, 1925, one 9 by 12 rug at $56; 26 yards of stair carpet at $3.40 a yard; 24 window shades at $4.80 each. Mr. Wood made a deposit of $100 on the day of purchase. He made the final payment upon delivery Sept. 12th. How much did he pay the delivery man upon the receipt of the goods? Receipt the bill as you would have done if you had delivered the goods.

II

1. Add
   1,984,953
   2,168,906
   463,661
   114,953
   72,226

2. Subtract
   2,168,906
   1,984,953

3. Multiply 534,675 by 67.

4. Divide 954,055 by 65.

5. In 1924 133,500 persons passed the United States Civil Service tests. Of these 51% were appointed to positions. How many were appointed?

6. The number who passed these examinations was 60% of those examined. How many were examined?

7. Find the cost of 42 half-pint bottles of milk at 16 cents a quart.

8. A rug costing $40 is sold at an increase of 40%. What is the selling price?

III

1. Add
118,527
227,710
784,938
296,785
776,783
545,723
2,942,605

2. Multiply 3,677,136 by 79.

3. Divide 2,596,168 by 382.

4. Find the interest on $1400 at 6% for one year.

5. A radio costing $188 is sold for $282. What is the gain in per cent?

6. A piano is listed at $470 and is sold at a discount of 15%. What is the selling price?

7. A field is 40 rods long. How many feet long is it?

IV

1. Add
1,838,857
216,853
1,461,707
1,095,132
486,370
444,292
102,236

2. Multiply 1496 by 907.

3. Divide 2,241,560 by 1368.

4. Change 4.5 acres to square rods.

5. Change 336 quarts to bushels.

6. A farm is rented for $2000. It is valued at $20,000. The rent is what per cent of the valuation?

7. A house costing $12,000 is rented for 15% of the cost. What is the rent per month?

V

1. Add 2,331,729
   4,403,153
   1,482,855
   3,650,284
   2,241,560
   1,051,593

2. Multiply 8409 by 1208.

3. Divide 702,615 by 70,282.

4. Change 19,200 pounds to tons.

5. Find in acres the area of a field 165 feet wide by 660 feet long.

6. A machine operates 3 hours and 15 minutes each day for a week. It costs 30¢ an hour to operate. Find the cost of operation for a week.

7. Change 400 square feet to square inches.

8. Find the cost of 3400 cubic feet of gas at $3.12 per M.

VI

1. Determine the cost of 8500 gallons of water at $3 per M.

2. What must be paid for laying a walk 300 ft. long by 6 ft. wide at $1.50 per square yard?

3. Mr. White's store valued at $20,000 is operated so as to earn 12% on the investment. What are the yearly returns earned by the store?

4. Robert's father is agent for a candy making company. How much candy must he sell per month to earn $400 if his commission is 10%?

5. What is the interest on $8000 for 8 months at 6%?

6. Divide $\frac{7}{8}$ of 240 by 25% of 840.

7. Subtract 6% of $9000 from $9000. If $9000 is the cost and $540 is the loss, what is the loss per cent?

STANDARDIZED TEST — ADDITION

Pupils completing the fifth grade should be able to do correctly 6 of the examples given below in six minutes. Sixth grade pupils should be able to do 8 examples.

8276	8906	9184	9751	7267
3051	6372	9170	8441	8062
7116	2959	8594	7009	5563
8257	6106	5282	9567	4320
7933	4639	6041	2712	3921

7885	4226	2714	3941	7469
3250	8996	5337	3825	4250
1739	5247	8011	7559	5470
3823	4620	8507	3441	2088
9751	7267	8496	2914	7885

2339	9771	7864	1249	8476
8507	3404	7883	8975	8378
6274	2079	8240	9005	2840
8307	9597	9869	1573	8996
4262	2714	6794	3203	7469

STANDARDIZED TEST — SUBTRACTION

Pupils completing the fifth grade should be able to do correctly 11 of the examples given below in two minutes. Sixth grade pupils should be able to do 15 examples.

752	1839	987	1075	562
347	968	926	801	229
571	1308	1230	784	1897
443	847	968	506	152
1935	710	1077	856	1119
371	468	511	698	759
853	931	1028	1377	916
380	463	774	802	624
739	1852	975	1087	516
367	948	906	821	239

STANDARDIZED TEST — DIVISION

Pupils completing the fifth grade should be able to do correctly 13 of the examples given below in twenty minutes. Sixth grade pupils should be able to do 20 examples.

82)3854	43)1591	74)2664
31)1953	63)3591	94)4042
21)1344	53)4452	83)5312
42)672	71)5183	32)2304
62)2108	93)5022	23)782
51)2703	84)7140	41)3567
73)6278	33)1386	64)5312
92)6624	24)984	52)3484

STANDARDIZED TEST — MULTIPLICATION

Pupils completing the fifth grade should be able to do correctly 7 of the examples given below in eight minutes. Sixth grade pupils should be able to do 15 examples.

560	807	617	840	730
37	59	508	80	96
609	435	790	940	307
70	308	60	38	42
682	870	780	502	386
409	40	56	68	207
150	850	401	817	460
90	72	80	109	30
730	605	392	590	390
52	84	306	30	47

STANDARDIZED TEST — MULTIPLICATION

Pupils completing the fifth grade should be able to do correctly 9 of the examples given below in twelve minutes. Sixth grade pupils should be able to do 14 examples.

4857 × 36	5718 × 92	6942 × 58	4065 × 47
9625 × 23	6123 × 64	7486 × 75	9027 × 89
1253 × 38	5376 × 76	3786 × 49	5492 × 53
2684 × 85	7953 × 29	5379 × 27	6824 × 64

STANDARDIZED TEST — DIVISION

Pupils completing the fifth grade should be able to do correctly 4 examples given below in twenty minutes. Sixth grade pupils should be able to do 6 examples.

Copy these examples as you do them.

47)27589	79)36893	36)28296
68)31824	96)56064	28)21980
57)22572	89)25365	48)32304
76)36708	67)39932	98)46844

STANDARDIZED TEST — ADDITION OF FRACTIONS

Pupils completing the fifth grade should be able to do correctly 6 of the examples given below in five minutes. Sixth grade pupils should be able to do 8 examples.

Reduce your answers to lowest terms.

$\frac{1}{6} + \frac{1}{3} =$ $\qquad$ $\frac{3}{10} + \frac{2}{5} =$

$\frac{5}{9} + \frac{2}{3} =$ $\qquad$ $\frac{5}{6} + \frac{1}{2} =$

$\frac{1}{8} + \frac{1}{2} =$ $\qquad$ $\frac{5}{6} + \frac{7}{12} =$

$\frac{3}{4} + \frac{1}{2} =$ $\qquad$ $\frac{1}{3} + \frac{1}{12} =$

$\frac{1}{2} + \frac{7}{10} =$ $\qquad$ $\frac{3}{4} + \frac{5}{12} =$

$\frac{5}{8} + \frac{1}{4} =$ $\qquad$ $\frac{1}{2} + \frac{5}{12} =$

$\frac{1}{6} + \frac{2}{3} =$ $\qquad$ $\frac{4}{5} + \frac{7}{10} =$

$\frac{5}{8} + \frac{3}{4} =$ $\qquad$ $\frac{5}{6} + \frac{1}{2} =$

STANDARDIZED TEST — SUBTRACTION OF FRACTIONS

Pupils completing the fifth grade should be able to do correctly 6 of the examples given below in ten minutes. Sixth grade pupils should be able to do 8 examples.

Reduce your answers to lowest terms.

$\frac{3}{4} - \frac{2}{5} =$ $\qquad$ $\frac{5}{6} - \frac{3}{4} =$

$\frac{1}{2} - \frac{2}{7} =$ $\qquad$ $\frac{7}{10} - \frac{1}{6} =$

$\frac{2}{3} - \frac{1}{2} =$ $\qquad$ $\frac{5}{6} - \frac{2}{15} =$

$\frac{3}{4} - \frac{1}{3} =$ $\qquad$ $\frac{7}{9} - \frac{1}{6} =$

$\frac{2}{3} - \frac{3}{5} =$ $\qquad$ $\frac{5}{6} - \frac{3}{8} =$

$\frac{3}{4} - \frac{2}{7} =$ $\qquad$ $\frac{7}{12} - \frac{3}{8} =$

$\frac{5}{6} - \frac{3}{5} =$ $\qquad$ $\frac{8}{15} - \frac{4}{9} =$

$\frac{4}{5} - \frac{1}{3} =$ $\qquad$ $\frac{7}{10} - \frac{1}{8} =$

STANDARDIZED TEST — MULTIPLICATION OF FRACTIONS

Pupils completing the fifth grade should be able to do correctly 6 of the examples given below in two minutes. Sixth grade pupils should be able to do 10 examples.

Reduce your answers to lowest terms.

$\frac{2}{3} \times \frac{3}{4} =$ $\quad$ $\frac{2}{5} \times \frac{3}{7} =$

$\frac{5}{12} \times \frac{3}{5} =$ $\quad$ $\frac{4}{9} \times \frac{2}{5} =$

$\frac{1}{3} \times \frac{3}{8} =$ $\quad$ $\frac{1}{2} \times \frac{1}{3} =$

$\frac{2}{5} \times \frac{3}{4} =$ $\quad$ $\frac{4}{5} \times \frac{1}{3} =$

$\frac{7}{12} \times \frac{4}{7} =$ $\quad$ $\frac{3}{8} \times \frac{1}{4} =$

$\frac{2}{7} \times \frac{1}{6} =$ $\quad$ $\frac{1}{3} \times \frac{1}{2} =$

$\frac{4}{15} \times \frac{5}{8} =$ $\quad$ $\frac{4}{5} \times \frac{7}{9} =$

$\frac{1}{6} \times \frac{3}{10} =$ $\quad$ $\frac{5}{12} \times \frac{2}{5} =$

STANDARDIZED TEST — DIVISION OF FRACTIONS

Pupils completing the fifth grade should be able to do correctly 8 of the examples given below in eight minutes. Sixth grade pupils should be able to do 10 examples.

Reduce your answers to lowest terms.

$\frac{2}{5} \div \frac{1}{3} =$

$\frac{3}{8} \div \frac{2}{3} =$

$\frac{3}{7} \div \frac{4}{5} =$

$\frac{1}{2} \div \frac{1}{3} =$

$\frac{2}{3} \div \frac{3}{4} =$

$\frac{3}{5} \div \frac{3}{4} =$

$\frac{4}{5} \div \frac{1}{2} =$

$\frac{5}{12} \div \frac{4}{9} =$

$\frac{4}{7} \div \frac{2}{3} =$

$\frac{5}{6} \div \frac{5}{8} =$

$\frac{7}{12} \div \frac{4}{9} =$

$\frac{2}{3} \div \frac{8}{9} =$

$\frac{4}{7} \div \frac{8}{11} =$

$\frac{1}{4} \div \frac{1}{6} =$

$\frac{2}{5} \div \frac{3}{7} =$

$\frac{3}{4} \div \frac{2}{9} =$

STANDARDIZED TEST — ARITHMETIC PROBLEMS

See suggestions in the introduction for using standardized tests and the directions for scoring a pupil's work upon these problems. A score is given for a correct principle (P) and correct answer (C). Sixth grade pupils should make a score of 14 on correct principle (P) and a score of 10 on correct answer (C). Seventh grade pupils should make scores of 20 and 13.

Solve these problems in the way that you have been taught. Arrange your work so that it can be easily understood in marking your papers but you are not expected to copy. Number the work for each problem. Be sure to put down all of the work. Solve the problems in the order in which they are given. Work rapidly but remember that a problem must be done correctly to count on your score. You will be allowed twenty-five minutes to do as many of these problems as you can.

1. A girl having $\frac{3}{4}$ yd. of ribbon bought $\frac{1}{8}$ yd. more. What part of a yard had she then?

2. A piece of ribbon $4\frac{3}{8}$ yd. long is cut from a bolt containing 10 yd. How many yards are left?

3. There are 31.5 gallons in a barrel. How many gallons are there in 63 barrels?

4. If a horse eats $\frac{3}{8}$ bu. of oats a day, how long will 6 bu. last?

5. When a 20-pound cheese is worth $1.90, how much will a 10-pound cheese cost?

6. Four loads of hay are to be put into a barn. The first load weighs 1.125 tons; the second, 1.75 tons; the third, 1.8 tons; the fourth 1.9 tons. Find the weight of the four loads.

7. A baker used $\frac{3}{5}$ lb. of flour to a loaf of bread. How many loaves could he make from a barrel (196 lb.) of flour?

8. My telephone bill is \$12.85 a month. At that rate how much should I pay in $2\frac{3}{4}$ years?

9. A man spent \$6.50 for board, \$12.25 for clothing, \$5.20 for books, and had \$12 left. How many dollars and cents had he at first?

10. A boy saves $1\frac{3}{4}$ cents on a picture by doing his own developing and printing. This makes a saving of how much on each dozen pictures?

11. Make out the following account for a day. Cash on hand, \$174.30; Receipts, mdse. \$12.50, \$6.75, \$0.42, \$17.30, \$9.50, \$42.75; Expenses, Perry and Co., bill, \$75.82.

12. Muslin is to be bought for 12 new curtains each requiring $2\frac{7}{8}$ yd. How much will the muslin cost at $12\frac{1}{2}$ cents a yard?

13. A market man has 7850 pounds of ice put into his refrigerator at one time. How much does it cost at \$3.90 a ton?

14. A man bought two suits of clothes, one costing \$35.75 and the other \$28.50. How much more did the one cost than the other?

15. A farmer raised 500 bushels of wheat on a field of 40 acres. What was the average yield per acre?

SUBTRACTION METHODS

For the convenience of teachers, three methods of subtraction are here illustrated.

Continental (Austrian) Method

42.96	Say, "7 and **9** are 16
9.27	3 and **6** are 9
33.69	9 and **3** are 12
	1 and **3** are 4"

In this method we consider subtraction the converse of addition, the *language of addition* is employed, and "carrying" is done as in addition.

It is also called the "making change" method and the method of "complementary addition."

Equal Addition Method

42.96	Say, "7 from 16 leaves **9**
9.27	3 from 9 leaves **6**
33.69	9 from 12 leaves **3**
	1 from 4 leaves **3**"

In this method the carrying is explained by saying "having added 10 to 6 to make it 16, we must add 10 (1 ten) to 2 making it 3," etc. The method is based upon the axiom "If the same number be added to each of two numbers, their difference is not changed." It is also called the "borrow and pay back" method.

Disintegration Method

42.96	Say, "7 from 16 leaves **9**
9.27	2 from 8 leaves **6**
33.69	9 from 12 leaves **3**
	0 from 3 leaves **3**"

In this method we "disintegrate" the minuend.

To the Teacher. — The application of the various subtraction methods to operations with mixed numbers is here illustrated.

The pupil should be drilled in but *one* of these. There are advantages in continuing the one already learned.

Continental (Austrian) Method.

4 Say "$\frac{1}{3}$ and $\frac{2}{3}$ (writing $\frac{2}{3}$) $= 1$ ($\frac{3}{3}$)."
$2\frac{1}{3}$ Carry 1 to 2 and call it 3.
$1\frac{2}{3}$ *Difference.* Say "3 and 1 (writing 1) $= 4$."

Equal Addition Method.

$4 + \frac{3}{3} = 4\frac{3}{3}$ Say "$\frac{1}{3}$ from $\frac{3}{3} = \frac{2}{3}$." Write $\frac{2}{3}$.
$2\frac{1}{3} + 1 = 3\frac{1}{3}$ Say "3 from 4 $= 1$." Write 1.
$1\frac{2}{3}$ *Difference.*

Disintegration Method.

$4 = 3\frac{3}{3}$ Say "$\frac{1}{3}$ from $\frac{3}{3} = \frac{2}{3}$." Write $\frac{2}{3}$.
$2\frac{1}{3} = 2\frac{1}{3}$ Say "2 from 3 $= 1$." Write 1.
$1\frac{2}{3}$ *Difference.*

Continental (Austrian) Method.

$4\frac{1}{4} = 4\frac{3}{12}$ Say "$\frac{4}{12}$ and $\frac{1}{12}$ (writing $\frac{1}{12}$) $= \frac{5}{12}$" ($1\frac{8}{12}$).
$2\frac{7}{8} = 2\frac{4}{12}$ Carry 1 to 2, making it 3.
$1\frac{11}{12}$ *Difference.* Say "3 and 1 (writing 1) $= 4$."

Equal Addition Method.

$4\frac{1}{4} = 4\frac{3}{12}$ $4\frac{3}{12} + \frac{7}{12} = 4\frac{5}{12}$
$2\frac{7}{8} = 2\frac{4}{12}$ $2\frac{4}{12} + 1 = 3\frac{4}{12}$
$1\frac{11}{12}$ *Difference.*

Say "$\frac{4}{12}$ from $\frac{5}{12} = \frac{11}{12}$." Write $\frac{11}{12}$.
Say "3 from 4 $= 1$." Write 1.

Disintegration Method.

$4\frac{1}{4} = 4\frac{3}{12} = 3\frac{15}{12}$
$2\frac{7}{8} = 2\frac{4}{12} = 2\frac{4}{12}$
$1\frac{11}{12}$ *Difference.*

Say "$\frac{4}{12}$ from $\frac{15}{12} = \frac{11}{12}$." Write $\frac{11}{12}$.
Say "2 from 3 $= 1$." Write 1.

The Multiplication Table

2 × 1 = 2	3 × 1 = 3	4 × 1 = 4	5 × 1 = 5
2 × 2 = 4	3 × 2 = 6	4 × 2 = 8	5 × 2 = 10
2 × 3 = 6	3 × 3 = 9	4 × 3 = 12	5 × 3 = 15
2 × 4 = 8	3 × 4 = 12	4 × 4 = 16	5 × 4 = 20
2 × 5 = 10	3 × 5 = 15	4 × 5 = 20	5 × 5 = 25
2 × 6 = 12	3 × 6 = 18	4 × 6 = 24	5 × 6 = 30
2 × 7 = 14	3 × 7 = 21	4 × 7 = 28	5 × 7 = 35
2 × 8 = 16	3 × 8 = 24	4 × 8 = 32	5 × 8 = 40
2 × 9 = 18	3 × 9 = 27	4 × 9 = 36	5 × 9 = 45
2 × 10 = 20	3 × 10 = 30	4 × 10 = 40	5 × 10 = 50
2 × 11 = 22	3 × 11 = 33	4 × 11 = 44	5 × 11 = 55
2 × 12 = 24	3 × 12 = 36	4 × 12 = 48	5 × 12 = 60
6 × 1 = 6	7 × 1 = 7	8 × 1 = 8	9 × 1 = 9
6 × 2 = 12	7 × 2 = 14	8 × 2 = 16	9 × 2 = 18
6 × 3 = 18	7 × 3 = 21	8 × 3 = 24	9 × 3 = 27
6 × 4 = 24	7 × 4 = 28	8 × 4 = 32	9 × 4 = 36
6 × 5 = 30	7 × 5 = 35	8 × 5 = 40	9 × 5 = 45
6 × 6 = 36	7 × 6 = 42	8 × 6 = 48	9 × 6 = 54
6 × 7 = 42	7 × 7 = 49	8 × 7 = 56	9 × 7 = 63
6 × 8 = 48	7 × 8 = 56	8 × 8 = 64	9 × 8 = 72
6 × 9 = 54	7 × 9 = 63	8 × 9 = 72	9 × 9 = 81
6 × 10 = 60	7 × 10 = 70	8 × 10 = 80	9 × 10 = 90
6 × 11 = 66	7 × 11 = 77	8 × 11 = 88	9 × 11 = 99
6 × 12 = 72	7 × 12 = 84	8 × 12 = 96	9 × 12 = 108

The Division Table

2 ÷ 2 = 1	3 ÷ 3 = 1	4 ÷ 4 = 1	5 ÷ 5 = 1
4 ÷ 2 = 2	6 ÷ 3 = 2	8 ÷ 4 = 2	10 ÷ 5 = 2
6 ÷ 2 = 3	9 ÷ 3 = 3	12 ÷ 4 = 3	15 ÷ 5 = 3
8 ÷ 2 = 4	12 ÷ 3 = 4	16 ÷ 4 = 4	20 ÷ 5 = 4
10 ÷ 2 = 5	15 ÷ 3 = 5	20 ÷ 4 = 5	25 ÷ 5 = 5
12 ÷ 2 = 6	18 ÷ 3 = 6	24 ÷ 4 = 6	30 ÷ 5 = 6
14 ÷ 2 = 7	21 ÷ 3 = 7	28 ÷ 4 = 7	35 ÷ 5 = 7
16 ÷ 2 = 8	24 ÷ 3 = 8	32 ÷ 4 = 8	40 ÷ 5 = 8
18 ÷ 2 = 9	27 ÷ 3 = 9	36 ÷ 4 = 9	45 ÷ 5 = 9
20 ÷ 2 = 10	30 ÷ 3 = 10	40 ÷ 4 = 10	50 ÷ 5 = 10
22 ÷ 2 = 11	33 ÷ 3 = 11	44 ÷ 4 = 11	55 ÷ 5 = 11
24 ÷ 2 = 12	36 ÷ 3 = 12	48 ÷ 4 = 12	60 ÷ 5 = 12
6 ÷ 6 = 1	7 ÷ 7 = 1	8 ÷ 8 = 1	9 ÷ 9 = 1
12 ÷ 6 = 2	14 ÷ 7 = 2	16 ÷ 8 = 2	18 ÷ 9 = 2
18 ÷ 6 = 3	21 ÷ 7 = 3	24 ÷ 8 = 3	27 ÷ 9 = 3
24 ÷ 6 = 4	28 ÷ 7 = 4	32 ÷ 8 = 4	36 ÷ 9 = 4
30 ÷ 6 = 5	35 ÷ 7 = 5	40 ÷ 8 = 5	45 ÷ 9 = 5
36 ÷ 6 = 6	42 ÷ 7 = 6	48 ÷ 8 = 6	54 ÷ 9 = 6
42 ÷ 6 = 7	49 ÷ 7 = 7	56 ÷ 8 = 7	63 ÷ 9 = 7
48 ÷ 6 = 8	56 ÷ 7 = 8	64 ÷ 8 = 8	72 ÷ 9 = 8
54 ÷ 6 = 9	63 ÷ 7 = 9	72 ÷ 8 = 9	81 ÷ 9 = 9
60 ÷ 6 = 10	70 ÷ 7 = 10	80 ÷ 8 = 10	90 ÷ 9 = 10
66 ÷ 6 = 11	77 ÷ 7 = 11	88 ÷ 8 = 11	99 ÷ 9 = 11
72 ÷ 6 = 12	84 ÷ 7 = 12	96 ÷ 8 = 12	108 ÷ 9 = 12

Linear Measure

12 inches	= 1 foot
3 feet	= 1 yard
$5\frac{1}{2}$ yards (or $16\frac{1}{2}$ ft.)	= 1 rod
320 rods	= 1 mile (statute)

Square measure

144 square inches	= 1 square foot
9 square feet	= 1 square yard
$30\frac{1}{4}$ square yards	= 1 square rod
160 square rods	= 1 acre
640 acres	= 1 square mile

Liquid Measure

4 gills	= 1 pint
2 pints	= 1 quart
4 quarts	= 1 gallon

Dry Measure

2 pints	= 1 quart
8 quarts	= 1 peck
4 pecks	= 1 bushel

Weight

16 ounces	= 1 pound
100 pounds	= 1 hundredweight
2000 pounds	= 1 ton

A long ton weighs 2240 pounds.

Counting

12	= 1 dozen
12 dozen	= 1 gross
12 gross	= 1 great gross

A score = 20

Time

60 seconds	=	1 minute
60 minutes	=	1 hour
24 hours	=	1 day
7 days	=	1 week
365 days	=	1 year
366 days	=	1 leap year

September, April, June, and November have 30 days each. February has 28 days. In leap years it has 29 days. The other months have 31 days each.

United States Money

10 mills	=	1 cent
10 cents	=	1 dime
10 dimes	=	1 dollar
10 dollars	=	1 eagle

Troy Weight

24 grains	=	1 pennyweight
20 pennyweights	=	1 ounce
12 ounces	=	1 pound

Apothecaries' Weight

20 grains	=	1 scruple
3 scruples	=	1 dram
8 drams	=	1 ounce
12 ounces	=	1 pound

English Money

14 farthings	=	1 penny
12 pence	=	1 shilling
20 shillings	=	1 pound

French Money

100 centimes = 1 franc

German Money

100 pfennigs = 1 mark

Arc and Angle Measure

60 seconds	=	1 minute
60 minutes	=	1 degree
An arc of 360°	=	1 circumference

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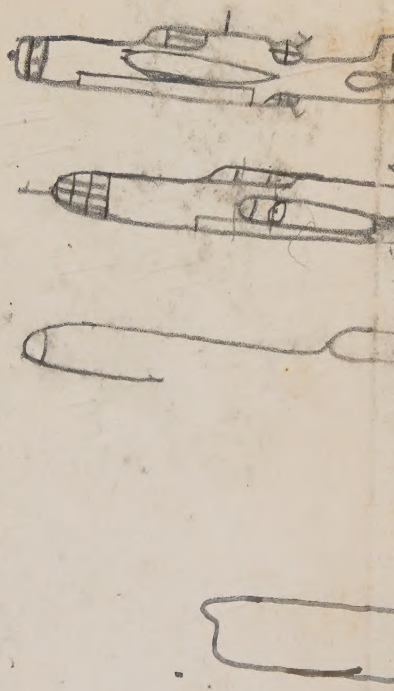
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